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EDITORIAL

Agricultural Extension in Ceylon

IN any country the functions of an Agricultural Department are mainly threefold : laboratory and field research on the problems of agriculture of that country, the " putting across " of the results of this research, and the training of youth in modern agricultural practices. The second of these two functions is commonly termed *Agricultural Extension*. It is, of the three, perhaps the most important from the point of view of agricultural development, for research by itself is not enough in the field of agriculture unless it is integrated with a properly organized extension service.

The *modus operandi* of extension must obviously vary in the different countries, but certain features are common to all agricultural extension organizations in democratic communities. These are briefly : (1) the cultural and social background against which these activities are to be carried out must receive primary consideration. In other words, any extension work must be developed in harmony with the basic attitudes and institutions of the people ; (2) the aim of extension officers should be to serve the people, by working *with* them and *for* them in the promotion of their agricultural advancement. Self-help and co-operation on the part of the individuals of the community are essential pre-requisites for success in the extension field ; and finally, (3) those who set out to be exponents of a revitalized agriculture in a country should be charged with the dynamic energy, earnestness and zeal which characterized the apostles of a new ideology or creed. If these conditions are satisfied, the approach to achieving the aim of extension work, i.e., to help the farmer " to apply science to the day-to-day routine of farming ", could be varied to suit the particular conditions and circumstances.

Agricultural extension in Ceylon dates back to 1904 when the Ceylon Agricultural Society was formed and even earlier. In those early days the work of the Department of Agriculture, then known as the Department of the Royal Botanic Gardens, was concerned primarily with research, particularly on the permanent crops. The Ceylon Agricultural Society was formed " to encourage the advance of the agricultural community by improved methods of cultivation and more useful selection in stock breeding ". The Director of the Royal Botanic Gardens at the time, Dr. J. C. Willis, writes in his administration report of that year that " the object of the society is to get the native cultivator and especially the villager, by means of the wealthier local landowners and planters and to bring to the hand of everyone who wishes it the experience and knowledge of the various branches of agriculture possessed by the Peradeniya staff, the Government Veterinary Surgeon, and other officials, and as far as possible also that of the various experienced planters and agriculturists belonging to the Society ". The Society appointed its own small staff of Instructors to carry out its objectives and these officers were for many years under the able guidance of Mr. Christie Drieberg while he was its Secretary. The Society has many achievements to its credit, among others the introduction of new paddy varieties and the conduct of trials and demonstrations on transplanting, green and artificial manuring of the crop, the use of the light iron plough, the introduction of cotton, grapefruit and White Burley tobacco, apiculture, sericulture, &c. Today, nearly 50 years later, we are endeavouring to popularize the same practices though modified with experience and the result of research, but with greater confidence in their beneficial application and with a much wider appeal. These demonstrations now number several thousands per season and are mostly conducted by the cultivators themselves under the direction of the Agricultural Instructors or Food Production Officers and their assistants. They not only carry conviction to the farmer of the efficacy of the improved practices, but also teach him how to adopt them and benefit by them.

The extension work in the Island which in its present set-up was started in 1920 with the appointment of two Divisional Agricultural Officers, is now in the control of 10 Agricultural Officers each in charge of a Province or part of a Province. Under them are Senior Agricultural Instructors who supervise the work of groups of Agricultural Instructors and Food Production Officers, totalling about 180 in number. In addition, each Agricultural Instructor or Food Production Officer has two or more demonstrators or overseers to assist him in his work. Besides the Agricultural Instructors, 25 Assistant Veterinary Surgeons working under the Agricultural Officers assist in carrying out the animal husbandry side of the extension programme. The propaganda Division assists the field Divisions in various extension activities, particularly in respect of shows, field days and visual aids.

The goal of extension in Ceylon is the maximum production of food (mainly paddy) with the object of achieving self-sufficiency in as short a period as possible. The means adopted for weaning the cultivator from his traditional methods of cultivation are varied. They include the conduct of demonstration trials on the cultivators' own fields, the holding of field days at which these methods are demonstrated and publicized among the

rural population, the intensive development of selected villages, the distribution of attractive posters illustrating the benefits of improved agricultural practices, cinema shows, popular broadcast talks, the issue of literature in the national languages, &c. A recent innovation is the formation of Young Farmers' Clubs of which there are over 113 at present. These Clubs have been started with the object of interesting the rural youth, both lads and girls, in home gardening, agriculture, animal husbandry, and home management. It is hoped thereby to instil into the coming generation a strong love for the land and for all that it connotes, and eventually to establish in the country a group of farmers ready to profit by every contribution that science can make towards their economic advancement. Another feature of this extension programme which deserves mention is the development village. In many divisions a number of villages are selected for concentrated attention. In the North-Central Province about 252 such development villages have been 'nursed' during the last season and the results have been most gratifying. Many tracts of paddy ranging from 30 to 100 acres in extent have produced yields of from 50 to 110 bushels per acre as a result of the adoption of the improved practices previously demonstrated by our officers. These measures include the use of pure line seed which the department issues either from its own farms or through private seed farmers, transplanting and harrowing of the crop, the use of the mould board plough, perimeter fencing, manuring, pest control, &c.

In this issue of *The Tropical Agriculturist* are presented in tabular form the results of some of our extension activities in 1950. They furnish quite an impressive record of achievement, and while they may not represent the maximum that could have been attained in these fields, they should serve as an encouragement to our extension staff to redouble their efforts in the future towards the achievement of our goal.

Cultivated Varieties of Banana in Ceylon

BY

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AND

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ASSISTANT IN ECONOMIC BOTANY

CENTURIES of cultivation have obscured the origin of the banana. Its use by man is over 5,000 years old. Linnaeus who named the species *Musa** *paradisiaca* and *M. sapientum*, was evidently familiar with the legend which associated the banana with Eve and the serpent. The fruit is represented in the sculpture of ancient Egypt and Assyria. When Alexander the Great invaded India in 327 B.C., his soldiers saw extensive plantations of bananas in the Indus valley. Early Sinhalese chronicles, including the *Mahavamsa*, mention the plant. In 341 A.D., King Buddhadasa recorded in his *Sarartha Sangrahawa*, the medicinal value of various parts of the plant. The banana filled an important place in the Sinhalese pharmacopeia.

It appears likely that the wild forms of banana arose in Pliocene times, in the rain forests of the Malay Archipelago, India, Ceylon, and Polynesia. The wild bananas possess a normal sexual process, and reproduce freely by seed. The cultivated races are the parthenocarpic, female-sterile, vegetative progeny of derivatives from the wild species. The relation of the cultivated Ceylon bananas to the wild species, *Musa balbisiana* Colla and *M. acuminata* Colla is discussed at length elsewhere by Chandraratna (1951). This paper presents a classification of the cultivated forms in Ceylon.

MATERIAL INVESTIGATED

The confusing synonymy, the liability of many characters to marked environmental variation, and the difficulty of preserving material satisfactorily in herbaria have made classification difficult. Sinhalese and Tamil names of banana varieties number over a hundred. As complete a collection of varieties in cultivation in Ceylon as was possible has been under study at the Research Station, Katugastota. It was found possible to lump all the material

* Linnaeus named the genus after Antonius Musa, a Roman Physician

in the collection into twenty-nine varieties, the greater number of which appear to be indigenous. Several of the varieties seem to have been brought from the South Indian mainland as is evidenced by the persistence of South Indian names, and a few are recognizable commercial varieties with a recorded history of introduction. In the latter class, the best known is the Gros Michel, the variety on which the thriving West Indian banana industry is based. In 1926, Dr. S. C. Harland, during his tour of South-East Asia for the purpose of " gaining information on the original home of the Gros Michel ", identified this variety with the *Pisang embon* and the *Pisang bunga* of the Malay Peninsula, and the *Thihmhwe* of Burma. On receipt of Dr. Harland's report in 1927, the Director of Agriculture, Ceylon, secured suckers of *Thihmhwe* from Hmawbi, and of *Pisang embon* from Serdang, Selangor. The wide currency of the name *Embon* in this country suggests the Ceylon material is largely derived from the Malayan introduction. It may be mentioned, in this connexion, that the indigenous *Anamalu* forms show resemblances to the Gros Michel. It is of considerable interest that the Gros Michel type is unrepresented in India (Howes, 1928).

The Red Banana was introduced by Director of Agriculture, Ceylon, from Bassein in the Bombay Presidency, in the same year as the Gros Michel, i.e., in 1927, and was established in Jaffna. A local variety, *Rathambala*, which is evidently identical with this introduction, had existed in Ceylon previously. *Rathambala* appears to be identical also with *Chev-valai* of India *Pisang rajah udang* of Malaya, *Klui naak* of Siam and *Shwehngetpyaw* of Burma (Howes, 1928).

There seems to be little doubt that the dwarf variety, *Binkehel*, is the Cavendish, Canary Island or Chinese Banana, which had in the past, been placed in the species, *M. nana* Lour. (*M. cavendishii* Paxt.), and is now referred to *M. acuminata* Colla. The original home of the Cavendish banana is Southern China. The Ceylon material was possibly derived from an introduction from Mauritius, not later than the first decade of the twentieth century. The pre-eminence of the Cavendish as a commercial banana in Hawaii and in most other countries into which it has been introduced is difficult to reconcile with its unimportance in Ceylon. Its recent introduction and its extreme susceptibility to bunchy top probably explain its comparative rarity in this country. The antecedents of the other introduced varieties are obscure. There are, however, several indigenous varieties which, like *Rathambala*, closely correspond to varieties in other countries. *Alukehel*, a variety indubitably native to Ceylon, is probably identical with *Pisang abu* of Malaya, and *Puwalu* with *Poovan* of South India. *Sapumal-anamalu* appears to be closely allied to *Pisang masak hijau* of Malaya, and to *Kliu hom kieu* of Siam. *Monthan* of Ceylon, *Pisang batu* of Java, *Kliu humuk* of Siam, and *Hpi-gyan* of Burma are possibly the same (Howes, 1928).

A key to the twenty-nine varieties into which the Ceylon material has been lumped is given below. The key is followed by detailed description of the varieties which have been alphabetically arranged. The extent to which we have drawn on Cheesman's work (1947 *et seqq.*) is evident throughout the paper. The descriptions particularly owe much to Cheesman. The

colour names follow Ridgway (1912). The means and their standard errors are recorded in the instance of the quantitative characters.

The common distinction between bananas (dessert varieties) and plantains (cooking varieties) is not emphasized in banana-growing countries, and possesses little systematic justification. The term banana is used by us to cover both dessert and cooking types.

RANGE OF VARIATION IN CULTIVATED BANANAS

The Inflorescence.—A male bud usually terminates the inflorescence. Two readily recognizable types of male bud exist, viz., the type in which the bracts extend to the apex—the " convolute " bracts of Cheesman—and the type in which the bracts do not reach the apex—the " imbricate " bracts of Cheesman. The nature of the male bud is one of the most constant characters in banana varieties, and is of considerable taxonomic value. " Convolute " bracts point to *acuminata* affinities, and occur in cultivated forms that can be referred to *M. paradisiaca* L. and *M. sapientum* L. " Imbricate " bracts occur in all the four species, *M. balbisiana* Colla, *M. acuminata* Colla, *M. paradisiaca* L. and *M. sapientum* L. No cultivated varieties are, of course, included in *M. acuminata* (Cheesman, 1948).

Striking variations in male bud shape exist. Three main shapes can be recognized on the basis of the position of the greatest diameter, viz., turbinate, ovoid and ellipsoid.

Cheesman (1947) attaches importance to the mode of lifting of the bracts. The lifting of a single bract at a time is an *acuminata* charcter, and the simultaneous lifting of several bracts characterizes *balbisiana* derivatives. We have, however, observed variation in this character within the limits of the same variety.

The outer surface of the bracts composing the male bud varies in colour from violet to purple. The closeness and depth of logitudinal ribs and the profusion of bloom on the outer surface of the bracts are subject to considerable variation. The colour of the inner surface of the bracts is of greater diagnostic value. A dark crimson colour extending to the bract base indicates *balbisiana* blood. A lighter red paling to the base is an *acuminata* trait (Cheesman, 1947). There is varietal variation in the depth of the transverse corrugations of the inner surface. The raised bracts roll back on fading, the degree of revolution varying with varieties. The bracts in all Ceylon varieties except *Binkehel* are deciduous early. In *Binkehel*, the persistent bracts form an untidy mass covering the rachis.

In rare instances, e.g., in the varieties *Randombe* and *Kochchikehel*, no male bud exists, and the female flowers (and accordingly the fruits) extend to the tip of the rachis. The behaviour of the variety, *Wadanekehel* is variable ; in this variety a male bud may or may not occur.

The Flowers.—Flowers and bracts are arranged spirally along the rachis. Each bract subtends two transverse rows of flowers. The basal

flowers are female, and except in *Randombe*, *Kochchikehel* and sometimes in *Wadanekehel*, the flowers higher up are male or neuter.

The perianth of the flower consists of an outer, anterior compound tepal or perigonium, and an inner, posterior free tepal or scale. The compound tepal is conspicuously three-lobed at the apex, with two accessory teeth between and within the three main lobes. The inferior, trilocular ovary is surmounted by a single style. The male flowers possess short rudimentary ovaries and are shed early. No pollen has been observed in the male flowers of most of the cultivated varieties in Ceylon. Though these flowers are more appropriately named ' neuter ', the term ' male ' has been retained on analogy with the wild forms.

Commonly accepted interpretations regard the compound tepal and the free tepal as homologous with the calyx and the corolla respectively, or, in the alternative, consider the outer perianth whorl represented by the three main lobes of the compound tepal, and the inner perianth whorl by the two accessory teeth and the free tepal. Examination of the Ceylon material has revealed the existence of a wide range of hitherto unrecorded variation in flower structure and has compelled a revision of prevailing morphological concepts. Frequently in the varieties *Suwandel* and *Walsuwandel*, and rarely in the variety *Kolikuttu*, the free tepal is replaced by a stamen resembling the five other members of the androecium in all respects but its posterior position and its occasionally reduced size. Moreover, in *Suwandel* and *Walsuwandel*, the free tepal assumes forms intermediate between a typical tepal and a stamen. These aberrant types suggest that the free tepal represents the sixth posterior stamen, and not, as the usual interpretations claim, the corolla or the posterior petal.

Free tepals vary somewhat in size and shape. The apex of the free tepal may terminate in an acute, acuminate or, most commonly, mucronate apicula. A mucronate apicula arising from a markedly emarginate apex may give the free tepal a tricuspidate appearance as in the varieties *Marathamana*, *Ratakehel*, *Rathambala*, and *Galanamalu*. The free tepal may show conspicuous transverse corrugations below the apicula as in the variety *Walsuwandel*. The flower of *Alukehel* occasionally possesses two or three free tepals.

Most varieties possess a single undivided style and a terminal stigma. *Seenikehel* has a distinctly 3-lobed stigma, and *Ratakehel* has a deeply 3-fid style. Three separate styles occasionally occur in the male flower of *Wadanekehel*, but not in the female. The style is straight in most varieties. In *Honderawala*, the lower half of the style exhibits a sigmoid bend. A bend in the upper half of the style occasionally occurs in *Kolikuttu*.

The distribution of anthocyanin pigment in the flower is of value in classification although colour intensity varies with the degree of shade. Red pigment in the tepals is most pronounced in varieties with *balbisiana* blood.

The Fruit : Fruit shape has considerable taxonomic value. Strongly angled and cylindrical fruits are *balbisiana* and *acuminata* traits respectively. Varieties derived from *M. acuminata* possess fruits with a pronounced acumen. A blunt fruit apex is a *balbisiana* character.

Fruit size and pericarp thickness vary widely, and are characters of economic interest. The pericarp may or may not yellow readily when ripe. In rare instances, e.g., in *Rathambala*, the ripe pericarp is pigmented red. The brittleness and thinness of the pericarp determines to some extent the satisfactoriness with which a variety stores and transports.

Flesh colour is limited largely to shades of yellow. There is considerable variation in the sweetness and acidity of the flesh. Good-quality dessert varieties invariably possess *acuminata* blood.

Fruit Bunch : The orientation of the bunch and the degree of compaction of the fruit vary. In most varieties, the mature bunch is pendent. In some instances, however, the orientation is horizontal or subhorizontal. In pendent bunches, fruits often show negatively geotropic reflexing of fruits. The rachis and peduncle may be glabrous, or may show a tawny pubescence. Pubescence is an *acuminata* character.

The Leaf : The adaxial channel in the petiole is a particularly valuable diagnostic character. *Acuminata*-derived varieties have an open adaxial channel with scarious margins. A closed channel indicates a *balbisiana* ancestor. Both sides of the lamina base may be rounded, or one side may be rounded and the other acute. In the former instance the lamina base may be cordate or the two rounded sides may meet the petiole at different levels. The lamina apex is of less value in classification than the base. The apex may transversely, obliquely or irregularly truncate. The adaxial surface of the lamina is usually darker green than the abaxial surface. In a few instances, the lamina tends to be yellowish green.

The leaf sheath and the pseudostem show brown-black blotches. The amount of blotching varies greatly with the variety and is a measure of the affinity to *M. acuminata.*

Habit : Varieties differ in the frequency of stooling, and in the robustness and inclination of the stems. These characters are, however, of little value in classification. The leaf midribs of sword suckers in *acuminata* derivatives stand out stiffy. In *balbisiana* forms, midribs tend to curve.

DISEASES AND VARIETAL SUSCEPTIBILITY

Bunchy Top.—This virus disease introduced from Fiji in 1913, is the most serious hazard in banana growing in Ceylon. Plants derived from infected suckers remain stunted and develop a rosette of small and somewhat erect leaves—hence the name ' bunchy top '. When secondary infection of adult plants occurs, the leaves exhibit a characteristic green streaking along the secondary veins. Although the aphid, *Pentalonia nigronervosa* functions as a vector, the use of infected suckers as planting material provides the chief means of spread. All the varieties in Ceylon succumb to the disease, but marked differences in susceptibility exist. The following are the most susceptible varieties : *Alukehel*, *Binkehel*, *Etamuru*, *Kithala*, *Kochchikehel*, *Kolikuttu*, *Ratakehel*, and *Suwandel.*

Panama Disease.—(*Fusarium oxysporum* Fr.) This disease which ravaged the banana industry in the West Indies, though common, is not

troublesome in Ceylon. The chief symptom is a wilt of the leaves. The vascular bundles in the rhizome are discoloured red, and the pseudostems often split longitudinally. *Hondarawala* and *Suwandel* are the most resistant of the Ceylon varieties.

Anthracnose (*Gloeosporium musarum*. Cooke and Massee). This fungus invades the developing fruits of only the cooking varieties, *Alukehel*, *Etamuru*, and *Mondan*. Affected fruits blacken and shrivel, but remain attached to the rachis.

KEY TO CULTIVATED VARIETIES OF BANANA IN CEYLON

A. Bracts of male bud not extending to apex
B Adaxial channel of petiole closed
C Male bud turbinate .. .. .. *Sudumuwaethi kehel*
CC Male bud ovoid
D Fruit pruinose .. .. *Alukehel*
DD Fruit not pruinose .. .. .. *Etamuru*
CCC Male bud ellipsoid
D Fruit pruinose .. .. *Sambel*
DD Fruit not pruinose
E Peduncle glabrous ; fruit bunch subhorizontal .. .. *Hambanpuwalu*
EE Peduncle pubescent ; fruit bunch pendent .. .. *Mondan*
BB Adaxial channel of petiole open
D Lamina base cordate
E Petiole channel narrowly open
F Peduncle glabrous ; styles three .. .. .. *Wadanakehel*
FF Peduncle pubescent ; style single .. .. *Walsuwandel*
EE Petiole channel wide open
F Male bud turbinate
G Flesh white .. .. *Wathupalu*
GG Flesh yellow .. .. *Puwalu*
FF Male bud ellipsoid
G Dwarf ; bracts persistent .. .. .. *Binkehel*
GG Not dwarf ; bracts deciduous .. .. .. *Ratakehel*
DD Two sides of lamina base rounded and meeting petiole at different levels
E Petiole channel narrowly open
F Male bud ovoid .. .. .. *Rathkehel*
FF Male bud ellipsoid .. .. .. *Suwandel*
EE Petiole channel wide open
F Male bud turbinate .. .. .. *Hondarawala*
FF Male bud ellipsoid .. .. .. *Ranel*
DDD Lamina base rounded on one side and acute on the other
E Fruit large about 24 cm. long, angulate .. .. *Kithala*
EE Fruit small, about 13 cm. long cylindrical .. .. *Kolikuttu*
AA Bracts of male bud extending to apex
B Adaxial channel of petiole closed .. .. *Seenikehel*
BB Adaxial channel of petiole open
C Male bud turbinate ; lamina base cordate
D Fruit red .. .. *Rathambala*
DD Fruit green .. .. *Galanamalu*
CC Male bud ovoid ; lamina base rounded on one side and acute on the other
D Apex of free tepal tricuspidate .. .. .. *Marathamana*
DD Apex of free tepal mucronate

E Fruit small, about 11–12 cm. long .. .. *Navari*
EE Fruit large, about 16–23 cm. long
F Midrib pruinose
G Fruit ripens green .. .. .. *Meegon-anamalu*
GG fruit ripens yellow
H Vegetative parts pigmented purple .. .. *Pisang embon*
HH Vegetative parts unpigmented .. .. *Sapumal-anamalu*
FF Midrib not pruinose .. .. .. *Anamalu*
AAA Male bud absent
B Fruits large, about 33 cm. long.. .. .. *Kochchikehel*
BB Fruits small, about 11–12 cm. long
C Petiole channel narrowly open ; lamina base cordate .. *Wadanakehel*
CC Petiole channel wide open : two sides of lamina base rounded and meeting petiole at different levels .. .. *Randombe*

DESCRIPTIONS OF VARIETIES

1. Alukehel

Synonym : Neer.

Habit : Stools freely, stems inclined to the vertical ; suckers unpigmented,* mainly maiden.

Pseudostem : Grape green, tinged with purple, about 2½ metres high at flowering, about 22 cm. in diameter at base.

Leaf sheath : Unpigmented, exposed part pruinose with faint, brown-black markings.

Petiole : Pale green, 45±0·5 cm. long ; adaxial channel closed, margins not scarious.

Lamina : Pale green, 156±3·4 cm. long and 53 ± 0·9 cm. wide, base cordate, apex obliquely truncate.

Male bud : Ovoid ; bracts not extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts Corinthian purple, prominently ribbed ; inner surface acajou red, with transversely elongated pits.

Male flowers : About 18 per bract ; compound tepal eugenia red, 4·6 ± 0·11 cm. long and 1·3 ± 0·01 cm. wide ; lobes orange, sometimes reduced to two ; accessory teeth sometimes reduced to one or none, and sometimes displaced to middle of compound tepal ; free tepals sometimes two or three, 4·2 ± 0·04 cm. long and 1·9 ± 0·3 cm. wide with mucronate apicula ; stamens 4·4 ± 0·02 cm. long, filaments white ; style 5·1 ± 0·03 cm. long, white with orange stigma.

Fruit bunch : Pendent, very compact ; peduncle yellowish green, glabrous.

Fruit : 13 ± 0·2 cm. long, 4·3 ± 0·02 cm. in diameter, slightly curved, with 4–5 prominent angles ; pericarp very thick, about 3 mm., glaucous when unripe, antimony yellow when ripe ; flesh cream ; mean weight per fruit 2·4 ± 0·2 oz.

General : The most popula cooking variety in Ceylon. It is very susceptible to anthracnose and succumbs to bunchy top. It is extensively used in ayurvedic medicine, and is the earliest edible variety specifically mentioned in Sinhalese literature.

2. Anamalu

(Plate IIg)

Habit : Stools moderately ; suckers unpigmented, mostly sword.

Pseudostem : Very pale purple-green, about 2½ m. high at flowering, about 20 cm. in diameter at base.

Leaf sheath : Unpigmented, with occasional brown-black markings on exposed part.

* The pigments referred to are the anthocyanins.

Petiole : Apple green, 45 ± 1·0 cm. long, adaxial channel margin curved outward, unpigmented, scarious.

Lamina: Abaxial surface bright green, abaxial surface pale green, 221 ± 1·9 cm. long and 59 ± 1·2 cm. wide, irregularly truncate at apex, base rounded on one side and decurrent on the other.

Male bud : Ovoid ; bracts extending to apex, lifting one at a time, revolute on fading, outer surface vinaceous purple, longitudinal ribs not prominent, inner surface yellowish green with shallow transverse corrugations.

Male flowers : About 12 per bract ; compound tepal unpigmented, translucent, 4·1 ± 0·03 cm. long and 1·3 ± 0·04 cm. wide ; free-tepal 1·9 ± 0·03 cm. long and 1·2 ± 0·02 cm. wide, with a mucronate apicula ; stamen 4·1 ± 0·03 cm. long ; style 3·9 ± 0·03 cm. long.

Fruit bunch : Pendent, compact ; peduncle unpigmented, pubescent.

Fruit : 23 ± 0·2 cm. long, 4 ± 0·3 cm. in diameter, curved, subcylindrical but with 4–5 recognizable angles ; pericarp very thick, about 3 mm., lemon chrome when ripe ; flesh ivory yellow, soft ; mean weight per fruit 7 ± 0·1 oz.

General : A good dessert variety with a sour-sweet flavour, mentioned by Moon (1824).

3. Binkehel

(*Plate IIf*)

Synonyms : Naukehel, Pandi, Cavendish, Canary-Island or Chinese Banana.

Habit : Stools sparsely ; suckers deeply pigmented.

Pseudostem : Shaded deep brown-black, about 1·7 meters high at flowering, about 23 cm. in diameter at base.

Leaf sheath : Exposed part grape green with brown-black blotches ; covered part shaded faint purple.

Petiole : Pruinose, 15 ± 0·07 cm. long ; adaxial channel wide open, margins erect, scarious, bordered by evanescent purple line.

Lamina : Dark green on upper surface, 123 ± 2 cm. long and 62 ± 1·6 cm. wide, acutely truncate at apex, cordate at base.

Male bud : Ellipsoid ; bracts not extending to apex, lifting more than one at a time, not revolute on fading ; persistent outer surface of bracts burnt lake with pronounced longitudinal ribs and copious bloom, inner surface yellowish red.

Male flowers : About 16 per bract persistent ; compound tepal unpigmented, 3·9 ± 0·03 cm. long and 1·4 ± 0·02 cm. wide ; free tepal white, translucent with mucronate apicula 2·1 ± 0·04 cm. long and 1·1 ± 0·02 cm. wide ; stamens 3·6 ± 0·03 cm. long ; style 3·5 ± 0·01 cm. long tinged purple near the middle.

Fruit bunch : Pendent, moderately compact ; peduncle and rachis pubescent ; rachis clothed in persistent flowers and bracts.

Fruit : 15 ± 0·2 cm. long, 4·3 ± 0·05 cm. in diameter, curved, subcylindrical with 5 recognizable angles ; pericarp thick 2–3 mm. Scheele's green when unripe, pale yellowish green when ripe ; flesh pale orange yellow ; mean weight per fruit 5·5 ± 0·09 oz.

General : An excellent dessert variety, very susceptible to bunchy top.

4. Etamuru

Synonyms : Karu, Kaddu.

Habit : stools freely ; suckers unpigmented.

Pseudostem : grape green, covered part tinged faint purple, about 3 meters high at flowering, about 23 cm. in diameter at base.

Leaf sheath : unpigmented with sparse bloom on exposed part.

Petiole : 54±1·1 cm. long ; adaxial channel covered, margin incurved, not scarious.

Lamina : dark green on upper surface, 166±2 cm. long and 54±0·2 cm. wide, acutely truncate at apex, cordate at base ; upper surface of midrib unpigmented with sparse bloom, lower surface bright purple fading with age.

Male bud : ovoid ; bracts not extending to apex, lifting one at a time, revolute on fading ; outer surface of bracts Corinthian purple with well-marked ribs ; inner surface acajou red, transversely corrugated.

Male flowers : about 18 per bract ; compound tepal eugenia red, 4·8±0·02 cm. long and 1·5± 0·01 cm. wide; free tepal purple 2·6±0·03 cm. long and 2·0±0·02 cm. wide with mucronate apicula ; stamens 4·1±0·02 cm. long, filament pale purple; style 4·1±0·04 cm. long, pale purple.

Fruit bunch : pendent, compact, with very slight pubescence on peduncle.

Fruit : 13 ± 0·1 cm. long, 3·7 ± 0·2 cm. in diameter, straight to slightly curved with 4–5 prominent angles ; pericarp very thick, emerald green when unripe, light orange yellow when ripe ; flesh white.

General : A cooking variety susceptible to anthracnose and bunchy top. The name suggests that the fruits occasionally contain seeds. We have, however, observed none in the material we examined. Moon (1824) mentions *Aetamburu*.

5. Galanamalu

Synonym : Singha (?)

Habit : stools sparsely.

Pseudostem : pale purple-green with brown-black blotches, about 5½ meters high at flowering, about 109 cm. in diameter at base.

Leaf sheath : exposed part coloured brown black, covered part pale purple.

Petiole : 69±1·3 cm. long ; adaxial channel wide open, margins outcurved, scarious, with purple border.

Lamina : 338±6 cm. long and 96 ± 1·0 cm. wide, acutely truncate at apex, cordate at base ; upper surface of midrib unpigmented, with sparse bloom, lower surface with evanescent pale purple pigmentation.

Male bud : turbinate ; bracts extending to apex, lifting one at a time, revolute on fading ; outer surface of bracts dark maroon to purple, with moderately prominent ribs ; inner surface acojou red with deep broad, transversely elongated pits.

Male flowers : about 17 in two rows persist longer than bracts ; compound tepal white translucent, 6·0±0·6 cm. long and 2·2 ± 0·03 cm. wide ; free tepal tricuspidate, white, 3·5 ± 0·02 cm. long and 1·6 ± 0·03 cm. wide ; stamens off-white, 5·2 ± 0·03 cm. long ; style 5·6 ± 0·05 cm. long.

Fruit bunch : curved, compact, peduncle somewhat pubescent.

Fruit : 13·5±0·07 cm. long, 4·1±0·06 cm. in diameter, slightly curved, subcylindrical with 4–5 recognizable angles ; pericarp very thick, ripening lemon yellow, 4±0·1 oz.

General : A coarse-flavoured, dessert variety. Suckers of this variety occasionally arise from *Rathambala* rhizomes. Moon (1824) mentions *Singha*.

6. Hambanpuwalu

Synonym : Suramondan, Diyamondan.

Habit : stools freely ; stems slightly inclined to the vertical, suckers unpigmented.

Pseudostem : grape green, about 4 metres high at flowering, about 23 cm. in diameter at base.

Leaf sheath : unpigmented.

Petiole : 60±0·9 cm. long ; adaxial channel closed, margins not scarious.

Lamina : pale green, 154±3·4 cm. long and 50±0·6 cm. wide, cordate at base, obliquely truncate at apex ; midrib unpigmented, with sparse bloom on adaxial surface.

Male bud : ellipsoid bracts not extending to apex, lifting several at a time, moderately revolute on fading ; outer surface of bracts Corinthian purple, prominently ribbed ; inner surface acajou red, with transversely elongated pits.

Male flowers : about 14 per bract; compound tepal eugenia red, 5·3±0·3 cm. long and 1·5±0·01 cm. wide ; free tepal 3·1±0·04 cm. long and 2·0 ± 0·04 cm. wide, with acute apicula ; stamens 4·7±0·03 cm. long ; style 4·9±0·04 cm. long.

Fruit bunch : horizontal lax, peduncle yellowish green, glabrous.

Fruit : 18 ±0·2 cm. long, 4·7 ±0·05 cm. in diameter, slightly curved, angulate, apex blunt, pedicel long ; pericarp very thick 3–4 mm ; turtle green when unripe, light yellow shaded red when ripe ; flesh ivory white ; mean weight per fruit 5±0·6 oz.

General : a cooking variety, somewhat resistant to bunchy top.

7. Honderawala

(*Plate IIIi*)

Synonyms : Embul, Kadali, Thanekadali.

Habit : stools freely ; suckers with purple pigment.

Pseudostem : pale purple-green, about 3½ metres high at flowering, about 23 cm. in diameter at base.

Leaf sheath : pale purple-green, exposed part with brown-black blotches and sparse bloom.

Petiole : rose pink, pigment accentuated under shade, 61±0·8 cm. long; adaxial channel widely open, with outcurved, scarious, purple-edged wings.

Lamina : dark green, 241±3·5 cm. long and 67±0·7 cm. wide ; base rounded on both sides meeting petiole at different levels ; apex obliquely truncate ; midrib purple-green with copious bloom.

Male bud : turbinate ; bracts not extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts pruinose, violet; inner surface Vandyke red, with transversely elongated pits.

Male flowers : about 17 per bract; compound tepal 4·9±0·03 cm. long and 1·5±0·3 cm. wide, orange-tipped, with pale purple lines ; free tepal 2·3 ±0·01cm. long and 1·5±0·01 cm. wide, translucent white, tricuspidate with filiform apicula ; stamens 3·8±0·02 cm. long ; style 4·1±0·05 cm. long, with sigmoid flexure in lower half.

Fruit bunch : pendent, compact, peduncle and rachis pubescent.

Fruit : 11±0·2 cm. long, 3·2±0·05 cm. in diameter, slightly curved, subcylindrical, with pronounced acumen at apex, and short pedicel ; pericarp thin, about 2 mm., apple green when unripe, apricot yellow at full ripeness, flesh pale orange-yellow ; mean weight per fruit 1·8±0·05 oz.

General : A dessert variety mentioned by Moon (1824). The variety covers over half the plantain acreage in Ceylon. The flavour is subacid—hence the synonym *embul*—and the odour is characteristic. The bunches transport well ; ripe fruits do not drop. *Thane kadali* is, as its name implies, a sweeter strain. There are, moreover, slight differences in flesh and pericarp colour. These differences are, however, not sufficiently precise to warrant its separation.

8. Kithala

(*Plate IId*)

Habit : Stools freely.

Pseudostem : Reddish purple tinged with green, about 4½ metres high at flowering, about 23 cm. in diameter at base.

Leaf sheath : Exposed part pale purple-green with brown blotches.

Petiole : Pale purple, 62 ± 0·3 cm. long, adaxial channel narrowly open ; margins incurved, purple, not scarious.

Lamina : Pale green, 206 ± 5·1 cm. long and 76 ± 1·2 cm. wide ; base rounded on one side, decurrent on the other ; apex irregularly truncate ; midrib purple on abaxial side.

Male bud : Turbinate ; bracts extending to apex, lifting more than one at a time, not revolute on fading.

Male flowers : About 4 per bract, persist longer than bracts ; compound tepal off-white with two purple lines and dark yellow teeth, 4·9 ± 0·05 cm. long and 1·5 ± 0·05 cm. wide ; free tepal 2·4 ± 0·07 cm. long and 1·5—0·02 cm. wide, with mucronate filiform apicula, stamens 4·1 ± 0·03 cm. long ; style 4·2 ± 0·03 cm. long, shaded purple ; stigma orange.

Fruit bunch : Subhorizontal, lax.

Fruit : 24 ± 0·5 cm. long and 4·2 ± 0·04 cm. in diameter, not markedly reflexed on rachis, sickle-shaped, tapering gradually to apex with 3–5 prominent angles and very long pedicel ; pericarp of medium thickness, 2–3 mm., apple green when unripe, light orange yellow when ripe ; flesh hard, orange tinged with purple ; mean weight per fruit 7 ± 0·1 oz.

General : A very sweet, dessert variety, extremely susceptible to bunchy top ; it resembles *kochikehel* except in the possession of a male bud, bigger bunches, and more fruits per bunch. Moon (1824) mentions it.

9. Kochchikehel

(*Plate Ia*)

Synonym : Nendran.

Habit : Stools profusely.

Pseudostem : Coral pink shaded green, about 3 metres high at flowering, about 24 cm. in diameter at base.

Leaf sheath : Exposed part pale purplish green with occasional brown-black blotches ; covered part faintly purple.

Petiole : Pale purple, 57 ± 2·5 cm. long ; adaxial channel narrowly open ; margins incurved, not scarious.

Lamina : Light green ; 230 ± 1·1 cm. long and 58 ± 1·7 cm. wide ; base rounded on one side, decurrent on the other ; apex irregularly truncate ; midrib glaucous on abaxial surface.

Male bud : Absent.

Fruit bunch : Sub-horizontal, lax with very few hands ; peduncle glabrous, with purple pigment.

Fruit : 33 ± 0·5 cm. long and 4·8 ± 0·14 cm. in diameter, curved, twisted, tapering gradually to apex and base, with 3–5 mm. somewhat prominent angles and long pedicel ; pericarp very thick, apple green, tinged purple when unripe, buff yellow when ripe ; flesh pale orange yellow, hard ; mean weight per fruit 10 ± 0·3 oz.

General : An extremely sweet and relatively, very susceptible to bunchy top. The variety resembles *Kithala* except in the non-possession of a male bud and in the small number of hands per bunch. Moon (1824) mentions it. It is a hard-fleshed variety which is often steamed before eating, is reputed to be aphrodisiac, and is a common source of banana flour.

10. Kolikuttu

Synonym : Keppel, Cannanore, Calicut, sugar banana.

Habit : Stools sparsely ; suckers with pink pigment.

Pseudostem : Grape green with brown-black markings, about 3 meters high at flowering, about 26 cm. in diameter at base.

Leaf sheath : Exposed part pruinose, rose pink when young, tiber green with occasional brown-black markings when mature.

Petiole : 79 ± 1·4 cm. long ; adaxial channel open with incurved, scarious, purple-edged margins.

Lamina : Dark green on adaxial surface, glaucous on abaxial surface, 242 ± 4·5 cm. long and 72 ± 1·2 cm. wide ; base rounded on one side, decurrent on the other ; apex irregularly truncate.

Male bud : Turbinate ; bracts not extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts pruinose, mars violet ; inner surface vandyke red, with transversely elongated pits.

Male flowers : Persist longer than bracts, about 12 per bract ; compound tepal translucent white with faint purple shading and orange tip, 5·6 ± 0·02 cm. long and 1·8 ± 0·01 cm. wide ; free tepal tinged purple, 2·7 ± 0·04 cm. long and 2·0 ± 0·03 cm. wide, with mucronate apicula, stamens 5·5 ± 0·11 cm. long ; style 5·5 ± 0·08 cm. long, orange above and white below, often bent near stigma.

Fruit bunch : Pendent, somewhat lax ; peduncle pubescent, tinged purple.

Fruit : 13 ± 0·2 cm. long and 4·2 ± 0·05 cm. in diameter, with delicate fragrance, slightly curved, cylindrical, with short pedicel and often with persistent style ; pericarp thin, about 2 mm., apple green when unripe, yellow with rust red speckling when ripe, characteristically spotted by the fungus, *Macrophoma musae* (Cooks) Berl. & Vogl., and splitting longitudinally when over-ripe ; flesh ivory : mean weight per fruit 4 ± 0·13 oz.

General : *Kolikuttu* and *Suwandel* are the mostly highly-prized dessert varieties in Ceylon. *Kolikuttu* shows wide variation in the morphology of the free tepal which is often reduced in size, and is occasionally replaced by a staminode. The free tepal is sometimes duplicated or triplicated. The variety succumbs readily to bunchy top. Ripe fruits drop readily from bunch and render transport difficult. Moon (1824) mentions it.

11. Marathamana

(*Plate IIIk*)

Synonym : Marathuwa, Nillawela.

Habit : Stools with moderate frequency, stems slightly inclined to the vertical, suckers pigmented purple.

Pseudostem : Pale grape green with brown-black blotches, about 2·5 metres high at flowering, and about 22 cm. in diameter at base.

Leaf sheath : Exposed part grape green shaded purple, with brown-black blotches ; covered part pale purple.

Petiole : Bice green with pale purple shading, 43 ± 0·5 cm. long ; adaxial channel wide open ; margins vernonia purple, out-curved, scarious.

Lamina : Dark green on upper surface, 215 ± 5·3 cm. long and 73 ± 0·7 cm. wide ; base rounded on one side and decurrent on the other ; midrib glaucous on adaxial and purple on abaxial side.

Male bud : Ovoid ; bracts extending to apex, lifting one at a time, markedly revolute on fading, outer surface of bracts burnt lake, shallowly ribbed ; inner surface pale purple fading to yellow at base, with shallow, transverse corrugations.

Male flowers : About 14 per bract ; compound tepal off-white, 5·8 ± 0·07 cm. long and 2·2 ± 0·06 cm. wide ; free tepal 2·9 ± 0·03 cm. long, with tricuspidate apex ; stamens 4·8 ± 0·03 cm. long with white filaments ; style 4·8 ± 0·06 cm., off-white.

Fruit bunch : Pendent, lax, peduncle and rachis glabrous.

Fruit : 17 ± 0·2 cm. long, and 4·7 ± 0·05 cm. in diameter, slightly curved, somewhat angulate with a short pedicel ; pericarp very thick, about 4–5 mm. viridine green when unripe, apricot yellow at full ripeness ; flesh cream buff ; mean weight per fruit 6 ± 0·05 oz.

General : Moon (1824) mentions *Marathamana*. This is used in the Central Province as a cooking banana. *Marathuwa* appears slightly superior, and is used in the Jaffna peninsula as a dual-purpose banana.

12. Meegon-anamalu

Habit : Stools moderately ; suckers unpigmented.

Pseudostem : Chromium green with occasional brown-black markings, about 7 metres high at flowering, about 34 cm. in diameter at base.

Leaf sheath : Glaucous, with no brown-black markings.

Petiole : Light green, 56 ± 0·8 cm. long ; adaxial channel wide open with outcurved, scarious margins.

Lamina : Dark green on upper surface, 330 ± 5·3 cm. long and 96 ± 1·4 cm. wide ; base rounded on one side and decurrent on the other ; apex obliquely truncate ; midrib glaucous.

Male bud : Ovoid ; bracts extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts vinaceous purple shaded green, sparsely ribbed ; inner surface yellowish green.

Male flowers : About 13 per bract ; compound tepal 4·7 ± 0·05 cm. long and 1·4 ± 0·03 cm. wide, translucent white with yellow teeth ; free tepal translucent white 2·1 ± 0·04 cm. long and 1·4 ± 0·02 cm. wide, with mucronate, filiform apicula ; stamens 4·1 ± 0·04 cm. long with white filament ; style 4·3 ± 0·02 cm. long, white with pale purple shading and yellow stigma.

Fruit bunch : Pendent, compact, peduncle purplish green, somewhat pubescent.

Fruit : 23 ± 0·3 cm. long, and 14·9 ± 0·12 cm. in diameter, straight except for curvature at base, prominently angulate ; pericarp very thick, about 3–4 mm., grass green when purple, light viridine yellow when ripe ; flesh cream ; mean weight per fruit 10 ± 0·12 oz.

General : A relatively rare, dessert variety.

13. Mondan

(*Plate Ib*)

Synonyms : Vel, Vel-mondan, Averi-mondan.

Habit : Stools freely ; stems slightly inclined to the vertical.

Pseudostem : Grape green, about 4 metres high at flowering, about 23 cm. in diameter at base.

Leaf sheath : Unpigmented, with sparse bloom on exposed part.

Petiole : Light green, 69 ± 0·8 cm. long ; adaxial channel closed, margins incurved and not scarious.

Lamina : Dark green on upper surface, 195 ± 4·4 cm. long and 63 ± 1·2 cm. wide, cordate at base, obliquely truncate at apex ; lower surface of midrib pale pink, pruinose.

Male bud : Ellipsoid ; bracts not extending to apex, lifting more than one at a time, moderately revolute on fading ; outer surface of bracts Corinthian purple, pruinose ; inner surface acajou red, with transversely elongated pits.

Male flowers : About 15 per bract ; compound tepal 5·4 ± 0·05 cm. long and 1·5 ± 0·02 cm. wide ; free tepal pinkish purple, 3·3 ± 0·06 cm. long and 2·1 ± 0·04 cm. wide, acute at apex ; stamens 4·4 ± 0·05 cm. long with purple filaments ; style 5·1 ± 0·02 cm. long with tinge of purple and pale orange stigma.

Fruit bunch : Pendent, lax, peduncle and rachis moderately pubescent.

Fruit : 16 ± 0·2 cm. long, and 4·5 ± 0·08 cm. in diameter, straight or slightly curved with 4–5 prominent angles and blunt apex ; pericarp very thick, about 3–5 mm., lettuce green when unripe, apricot yellow with brown shading when ripe ; flesh cream ; mean weight per fruit 5·6 ± 0·12 oz.

General : A cooking variety, mentioned by Moon (1824) ; fruits occasionally succumb to anthracnose (*Gloesporium musarum* Cooke & Massee).

14. Navari

Habit : Stools freely, stems slightly inclined to the vertical ; suckers deeply pigmented.

Pseudostem : Purple green, about 6 metres high at flowering, about 27 cm. in diameter at base.

Leaf sheath : Exposed part with occasional brown-black markings ; covered part tinged purple.

Petiole : Dark green, 58 ± 1·8 cm. long ; adaxial channel wide open, margins outcurved and scarious.

Lamina : 285 ± 2·7 cm. long and 69 ± 1·4 cm. wide ; base rounded on one side, decurrent on the other ; apex obliquely truncate.

Male bud : Ovoid ; bracts extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts dark maroon, sparsely ribbed ; inner surface yellowish red with transversely elongated pits.

Male flowers : About 16 per bract ; compound tepal translucent white, yellow tipped, 3·7 ± 0·07 cm. long and 1·4 ± 0·27 cm. wide ; free tepal translucent white, 2·3 ± 0·03 cm. long and 1·1 ± 0·02 cm. wide, with mucronate apicula ; stamens 3·5 ± 0·02 cm. long, filaments white ; style 3·5 ± 0·03 cm. long, white with yellow stigma.

Fruit bunch : Pendent, compact ; peduncle glabrous, faint purplish green.

Fruit : 9·5 ± 0·3 cm. long, 2·1 ± 0·03 cm. in diameter, very slightly curved, cylindrical ; pericarp thin, brownish yellow when ripe ; flesh orange yellow.

General : A dessert variety, apparently endemic to Ceylon, and very rare even in this country. Moon (1824) mentions four forms of *Navari*, viz., *Sudu*, *Kalu*, *Tis*, and *Eta*. *Eta-navari* can be profusely seedy.

15. Pisang embon

Synonyms : Gros Michel, Bluefields.

Habit : Stools moderately ; suckers with purple pigment and heavy black blotches.

Pseudostem : Grass green tinged with purple, about 4 metres high at flowering, about 27 cm. in diameter at base.

Leaf sheath : Exposed part grape green with black blotches ; covered part yellowish green tinged purple.

Petiole : Cress green, 51 ± 1·0 cm. long ; adaxial channel wide open ; margins outcurved, scarious, purple.

Lamina : Dark green on adaxial side, light green on abaxial side, 247 ± 5·6 cm. long and 79 ± 2·0 cm. wide ; base rounded on one side and decurrent on the other ; apex obliquely truncate ; midrib pruinose, purple tinged on abaxial side.

Male bud : Ovoid ; bracts extending to apex, bracts lifting one at time, outer surface of bracts vinaceous purple, sparsely ribbed ; inner surface pale purple fading to yellow at base with very shallow transverse corrugations.

Male flowers : About 15 per bract ; compound tepal dirty white to light yellow, 5·6 ± 0·09 cm. long and 1·7 ± 0·04 cm. wide, teeth yellow ; free tepal translucent white, 2·1 ± 0·04 cm. long and 1·1 ± 0·02 cm. wide, with mucronate apicula ; stamens white, 5·1 ± 0·04 cm. long ; style white below, brownish yellow above.

Fruit bunch : Pendent, compact, rachis and peduncle pubescent.

Fruit : 16 ± 0·2 cm. long and 4·1 ± 0·1 cm. in diameter, curved, more or less circular in cross section, with acuminate apex and short pedicel ; pericarp of medium thickness, light cress green when unripe, buff yellow at full ripeness ; flesh maize yellow ; mean weight per fruit 5 ± 0·1 oz.

General : A dessert variety of excellent quality, introduced by the Department of Agriculture in 1927 from Serdang, Selangor.

16. Puwalu

(Plate IIIh)

Habit : Stools moderately ; suckers unpigmented.

Pseudostem : Apple green, about 3 metres high at flowering, about 25 cm. in diameter at base.

Leaf sheath : Exposed part light grape green with faint brown-black markings.

Petiole : Light green, 56 ± 0·6 cm. long ; adaxial channel wide open, not scarious, bordered by a purple line.

Lamina : Dark green on adaxial and light green on abaxial side, 238 ± 2·1 cm. long and 64 ± 1·0 cm. wide, cordate at base, obliquely truncate at apex.

Male bud : Turbinate ; bracts not extending to apex, lifting several at a time, well revolute on fading ; outer surface of bracts mars violet, pruinose, prominently ribbed ; inner surface vandyke red, with shallow transverse corrugations.

Male flowers : About 14 per bract ; compound tepal white with three purple stripes and orange tip, 4·7 ± 0·4 cm. long and 2·0 ± 0·04 cm. wide ; free tepal translucent white, 2·3 ± 0·02 cm. long and 1·5 ± 0·02 cm. wide, with mucronate 3·7 ± 0·04 cm. long ; style 4·1 ± 0·04 cm. long.

Fruit bunch : Subhorizontal, lax ; peduncle purplish green and slightly pubescent.

Fruit : 12 ± 0·2 cm. long, 3·9 ± 0·05 cm. in diameter, slightly curved and angulate ; pericarp thick, about 3–4 mm., wax yellow tinged brown when ripe ; flesh straw yellow ; mean weight per fruit 3 ± 0·07 oz.

General : A dessert variety, mentioned by Moon (1824).

17. Randombe

(Plate Ic)

Synonym : Muwanetikehel.

Habit : Stools moderately ; suckers pigmented pale purple.

Pseudostem : Purplish green, about 3 metres high at flowering, about 19 cm. in diameter at base.

Leaf sheath : Exposed part light grape green, with occasional brown-black markings.

Petiole : Pale purplish green, 63 ± 1·1 cm. long ; adaxial channel wide open ; margins erect or slightly incurved, scarious, pale purple.

Lamina : Yellowish green, 194 ± 2·5 cm. long and 55 ± 0·07 cm. wide ; two sides rounded at base and meeting petiole at different levels ; apex obliquely truncate.

Male bud : Absent.

Bracts : Outer surface perilla purple, sparsely ribbed ; inner surface light red or yellowish red.

Fruit bunch : Pendent, compact, peduncle and rachis glabrous.

Fruit : 11 ± 0·1 cm. long, 3·0 ± 0·08 cm. in diameter, slightly curved, subcylindrical with pronounced acumen ; pericarp thin, about 1·5 mm., light green when unripe, buff yellow when ripe ; flesh ivory white ; mean weight per fruit 1·4 ± 0·05 oz.

General : A dessert variety.

18. Ranel

Habit : Stools moderately.

Pseudostem : Coral pink on yellowish green background, about 3 metres high at flowering, about 21 cm. diameter at base.

Leaf sheath : Exposed part yellowish green tinged coral pink, with brown-black blotches ; covered part tinged faint purple.

Petiole : Pale purple when young, purplish yellow when mature, 54 ± 1·5 cm. long ; adaxial channel wide open ; margins outcurved, scarious, purple edged.

Lamina : Dark green or adaxial, light green on abaxial side, 192 ± 1·8 cm. long and 59 ± 0·4 cm. wide, cordate at base, irregularly truncate at apex ; midrib slightly pruinose, pale purple on abaxial side.

Male bud : Ellipsoid ; bracts extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts pruinose, mars violet, ribbed ; inner surface vandyke red, with shallow transverse corrugations.

Male flowers : About 10 per bract ; compound tepal translucent tinged faint purple, 4·1 ± 0·05 cm. long and 1·3 ± 0·02 cm. wide ; free tepal translucent white, 2·0 ± 0·02 cm. long and 1·3 ± 0·01 cm. wide with mucronate apicula ; stamens 3·9 ± 0·03 long with white filaments ; style 4·1 ± 0·02 cm. long, tinged faint purple ; stigma dark yellow.

Fruit bunch : Pendent, compact, peduncle purplish green, glabrous.

Fruit : 11 ± 0·1 cm. long, 3·6 ± 0·04 cm. in diameter, circular in diameter, circular in cross section, with pronounced acumen ; pericarp thin, about 2 mm., apple green when unripe, mustard yellow when ripe ; flesh cream ; mean weight per fruit 2 ± 0·1 oz. ; fruit resembles that of *Honderawala* but is rather better flavoured.

General : A relatively rare, dessert variety, mentioned by Moon (1824) over-ripe fruits readily drop.

19. Ratakehel

Habit : Stools sparsely ; suckers pigmented.

Pseudostem : Pale purplish green, about 2 metres high at flowering, about 13 cm. in diameter at base.

Leaf sheath : Exposed part yellowish green shaded rose pink, with occasional brown-black blotches.

Petiole : Yellowish green tinged rose pink, 43 ± 0·9 cm. long ; adaxial channel wide open ; margins shaded purple, incurved, not scarious.

Lamina : Dark green on upper surface, 132 ± 2·0 cm. long and 44 ± 0·5 cm. wide, cordate at base, obliquely truncate at apex ; midrib glaucous.

Male bud : Ellipsoid ; bracts reaching apex, lifting one at a time, not revolute on fading ; outer surface of bracts pruinose, burnt lake, with pronounced ribs ; inner surface vandyke red, with shallow, transverse corrugations.

Male flowers : About 8 per bract ; compound tepal purple, 4·6 ± 0·6 cm. long and 1·5 ± 0·01 cm. wide ; free tepal, tricuspidate, tinged purple, 2·2 ± 0·04 cm. long and 1·4 ± 0·03 cm. wide ; stamens 3·6 ± 0·02 cm. long with white filaments ; style 4·1 ± 0·04 cm. long 3–fid white with yellow stigma.

Fruit bunch : Pendent, somewhat lax ; peduncle and rachis slightly pubescent.

Fruit : 10 ± 0·06 cm. long, 3·2 ± 0·03 cm. in diameter ; subcylindrical with pronounced acumen ; pericarp of medium thickness, about 2–2·5 mm., apple green when unripe, mustard yellow at full ripeness ; flesh ivory yellow ; mean weight per fruit 1·6 ± 0·06 oz.

Remarks : A relatively rare dessert variety, susceptible to bunchy top.

20. Rathambala

Synonym : Chev-valai, Ratnavalu, Rathu-Kochchi.

Habit : Stools moderately ; suckers pigmented red.

Pseudostem : Deep hellebore red tinged green, about 6 metres high at flowering, about 32 cm. in diameter at base.

Leaf sheath : Exposed part purplish grey with brown-black blotches ; covered part pale purple.

Petiole : Daphne red, 65 ± 1·0 cm. long ; adaxial channel wide open ; margins outcurved, scarious, purple edged.

Lamina : Dark green on upper surface, 303 ± 3·2 cm. long and 97 ± 1·3 cm. wide, cordate at base, obliquely truncate at apex ; midrib glaucous on adaxial, Daphne red on abaxial side.

Male bud : Turbinate ; bracts reaching apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts purplish maroon, prominently ribbed ; inner acajou red, with shallow transverse corrugations.

Male flowers : About 18 per bract ; compound tepal white tinged purple, 6·1 ± 0·1 cm. long and 2·1 ± 0·04 cm. wide, teeth dark yellow ; free tepal translucent white, tricuspidate, 3·5 ± 0·04 cm. long and 1·7 ± 0·03 cm., wide ; stamens 5·1 ± 0·04 cm. long ; style 5·5 ± 0·04 cm. long.

Fruit bunch : Subhorizontal, compact, peduncle and rachis pubescent.

Fruit : 15 ± 0·2 cm. long, 4·3 ± 0·02 in diameter, curved, apex blunt, angulate with short pedicel ; pericarp very thick, peach red when ripe ; flesh pale orange yellow ; mean weight per fruit 5 ± 0·2 oz.

General : A coarse, sub-acid dessert variety, occasionally throws out *Gal-anamalu* suckers. It is mentioned by Moon who apparently considers it distinct from *Rathnawalu*.

21. Rathkehel

Habit : Stools sparsely, stems slightly inclined to the vertical, suckers reddish pink.

Pseudostem : Reddish pink, about 3½ metres high at flowering, about 24 cm. in diameter at base.

Leaf sheath : exposed part light green with faint purple tinge and occasional brown-black blotches ; covered part purplish green.

Petiole : Purplish green, 64±1·1 cm. long ; margins outcurved, scarious, purple-edged.

Lamina : Dark green on upper, light green on lower surface, 253 ±2·1 cm. long and 74±0·08 cm. wide ; two sides rounded at base and meeting petiole at different levels ; apex obliquely truncate ; midrib purple, pruinose on abaxial side.

Male bud : Ovoid ; bracts not extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts mars violet, pruinose, prominently ribbed ; inner surface dark maroon with deep, transversely elongated pits.

Male flowers : About 19 per bract ; compound tepal sulphur yellow, 5·4±0·04 cm. long and 1·7±0·03 cm. wide, teeth dark yellow ; free tepal sulphur yellow, 3·3±0·04 cm. long and 2·0±0·04 cm. wide ; stamens 4·9±0·05 cm. long, white below, and yellowish above.

Fruit bunch : Subhorizontal, lax, weighing about 10 lb. with about 6 hands and about 70 fruits ; peduncle shaded purple and somewhat pubescent.

Fruit : 7·6±0·1 cm. long, 2·8±0·2 cm. in diameter, slightly curved, subcylindrical with short pedicel and pronounced acumen ; pericarp thin, apple green when unripe, buff yellow with brown-black markings when ripe ; flesh seafoam yellow with minute seeds ; mean weight per fruit 1±0·04 oz.

General : A dessert variety. The red pigment implied in the name occurs in the vegetative parts and not in the fruit.

22. Sambel

Habit : Stools moderately, stems inclined to the vertical.

Pseudostem : Grape green, about 4 metres high at flowering, about 24 cm. in diameter at base.

Leaf sheath : Unpigmented, exposed part glaucous.

Petiole : Light green, 54±1·6 cm. long ; adaxial channel closed ; margins incurved, not scarious.

Lamina : Dark green on upper surface, 199±1·1 cm. long and 53±0·4 cm. wide, cordate at base, obliquely truncate at apex.

Male bud : Ellipsoid ; bracts not extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts Corinthian purple, pruinose, prominently ribbed ; inner surface acajou red with shallow transverse corrugations.

Male flowers : About 12 per bract ; compound tepal eugenia red, orange-tipped, $5{\cdot}2 \pm 0{\cdot}04$ cm. long and $1{\cdot}2 \pm 0{\cdot}03$ cm. wide : free tepal purple, large, $3{\cdot}2 \pm 0{\cdot}03$ cm. long and $2{\cdot}0 \pm 0{\cdot}04$ cm. wide with acute apex; stamens $4{\cdot}9 \pm 0{\cdot}04$ cm. long with pale purple filaments ; style $5{\cdot}0 \pm 0{\cdot}05$ cm. long white with yellow stigma.

Fruit bunch : Subhorizontal, lax ; rachis and peduncle glabrous.

Fruit : $20 \pm 0{\cdot}2$ cm. long and $5{\cdot}2$ cm. in diameter, strongly angulate, tapering gradually to apex ; pedicel long ; pericarp very thick, 4-5 mm., pruinose, pale olivine when unripe, cadmium yellow at full ripeness ; flesh cream ; mean weight per fruit $7 \pm 0{\cdot}2$ oz.

General : A good-quality cooking variety common in the Jaffna peninsula.

23. Sapumal-anamalu

Habit : Stools sparsely.

Pseudostem : Grape green tinged pale purple, about $5\frac{1}{2}$ metres high at flowering, about 25 cm. in diameter at base.

Leaf sheath : Unpigmented.

Petiole : Light green, $63 \pm 0{\cdot}6$ cm. long ; adaxial channel wide open ; margins outcurved, scarious, unpigmented.

Lamina : Dark green on upper surface, $341 \pm 2{\cdot}9$ cm. long and $82 \pm 0{\cdot}9$ cm. wide ; base rounded on side, acute on the other ; apex obliquely truncate ; midrib unpigmented, bloom sparse on adaxial and copious on abaxial side.

Male bud : Ovoid ; bracts extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts vinaceous-purple, sparsely ribbed ; inner surface yellowish green.

Male flowers : About 13 per bract ; compound tepal translucent white, yellow-tipped, $4{\cdot}9 \pm 0{\cdot}04$ cm. long and $1{\cdot}5 \pm 0{\cdot}04$ cm. wide ; free tepal translucent white, $2{\cdot}5 \pm 0{\cdot}02$ cm. long and $1{\cdot}6 \pm 0{\cdot}04$ cm. wide, with mucronate apicula ; stamens $4{\cdot}5 \pm 0{\cdot}02$ cm. long with white filaments ; style $4{\cdot}6 \pm 0{\cdot}04$ white tinged faintly purple, with yellow stigma.

Fruit bunch : Pendent, compact, with sparse pubescence on peduncle and rachis.

Fruit : $18 \pm 0{\cdot}08$ cm. long, and $3{\cdot}9 \pm 0{\cdot}02$ cm. in diameter, sub-cylindrical ; pericarp moderately thick, about 2–3 mm., apple green when unripe, pale lemon yellow when ripe ; flesh ivory yellow ; mean weight per fruit 3 ± 0.04 oz.

General : A good-quality dessert variety, resembles *Anamalu* but has shorter fruits and a more delicate flavour.

24. Seenikehel

Habit : Stools sparsely, resembles *Alukehel* in habit but has erect stems ; suckers unpigmented, mainly maiden.

Pseudostem : Bright green, about $2\frac{1}{2}$ meters high at flowering, about 24 cm. diameter at base.

Leaf sheath : Unpigmented, with faint brown-black markings on exposed part.

Petiole : Dark green, $53 \pm 0{\cdot}7$ cm. long ; adaxial channel completely closed ; margins incurved, not scarious, unpigmented.

Lamina : $189 \pm 8{\cdot}0$ cm. long and $53 \pm 1{\cdot}5$ cm. wide, cordate at base, obliquely truncate at apex ; midrib with sparse bloom and no pigment.

Male bud : Ovoid ; bracts extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts orange red, pruinose, closely ribbed ; inner surface spinel red, transversely corrugated.

Male flowers : About 20 per bract ; compound tepal large, alizarine pink, orange-tipped, $5 \cdot 9 \pm 0 \cdot 1$ cm. long and $1 \cdot 6 \pm 0 \cdot 02$ cm. wide ; free tepal translucent white, $2 \cdot 9 \pm 0 \cdot 04$ cm. long and $1 \cdot 4 \pm 0 \cdot 02$ cm. long ; style white, $5 \cdot 6 \pm 0 \cdot 04$, protrudes considerably beyond stamens, 3-lobed.

Fruit bunch : Long, pendent, compact, with glabrous, unpigmented peduncle.

Fruit : $14 \pm 0 \cdot 09$ cm. long, $3 \cdot 2 \pm 0 \cdot 02$ cm. in diameter, straight or slightly curved, somewhat angulate ; pericarp thin, about 2 mm., apple green when unripe, buff yellow when ripe ; flesh cream ; mean weight per fruit $2 \pm 0 \cdot 04$ oz.

General : A rare, very sweet, dessert variety.

25. Sudumuwa ethikehel

Habit : Stools moderately, stems inclined to the vertical.

Pseudostem : Yellowish green tinged pale purple, about 3 metres high at flowering, about 24 cm. in diameter at base.

Leaf sheath : With neither pigment nor brown-black markings.

Petiole : Grape green, $48 \pm 0 \cdot 6$ cm. long ; adaxial channel completely closed ; margins incurved not scarious.

Lamina : Light green, $178 \pm 2 \cdot 9$ cm. long and $51 \pm 0 \cdot 6$ cm. wide, cordate at base, obliquely truncate at apex ; midrib with evanescent, pale purple pigment.

Male bud : Turbinate ; bracts not reaching apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts mars violet, pruinose, prominently ribbed ; inner surface vandyke red, transversely corrugated.

Male flowers : About 10 per bract ; compound tepal $5 \cdot 4 \pm 0 \cdot 05$ cm. long and $1 \cdot 8 \pm 0 \cdot 06$ cm. wide, eugenia red with orange teeth ; free tepal pale purple, $2 \cdot 6 \pm 0 \cdot 02$ cm. long and $1 \cdot 4 \pm 0 \cdot 03$ cm. wide, with mucronate apicula ; stamens $4 \cdot 29 \pm 0 \cdot 04$ cm. long ; style $4 \cdot 9 \pm 0 \cdot 04$ cm. long, purplish white terminating in an orange stigma.

Fruit bunch : Small, pendent, with glabrous, light green peduncle.

Fruit : $11 \pm 0 \cdot 5$ cm. long, $3 \cdot 9 \pm 0 \cdot 09$ cm. in diameter, very slightly curved, sub-cylindrical, with acuminate apex and short pedicel ; pericarp thin, about 2 mm., apple green when unripe, buff yellow when ripe ; flesh cream ; mean weight per fruit $3 \pm 0 \cdot 07$ oz.

General : A rare dessert variety, resembling *Etamuru* in vegetative characters.

26. Suwandel

(*Plate IIIj*)

Habit : Stools moderately ; in suckers, bases of young leaves rose pink.

Pseudostem : Grape green with brown-black blotches, about $2\frac{1}{2}$ metres high at flowering, about 19 cm. in diameter at base.

Leaf sheath : Exposed part tiber green with sparse bloom and occasional brown-black markings ; covered part with copious bloom.

Petiole : Light green, $54 \pm 1 \cdot 3$ cm. long ; adaxial channel narrowly open ; margins slightly incurved, somewhat scarious, purple-edged.

Lamina : $197 \pm 3 \cdot 1$ cm. long and $59 \pm 1 \cdot 1$ cm. wide ; two sides of base rounded, meeting petiole at different levels ; apex obliquely truncate ; midrib unpigmented, bloom sparse on adaxial and copious on abaxial side.

Male bud : Ellipsoid, bracts not extending to apex, lifting one at a time, markedly revolute on fading ; outer surface of bracts mars violet, pruinose, prominently ribbed ; inner surface vandyke red, with shallow transverse corrugations.

Male flowers : About 15 per bract ; compound tepal translucent white, orange tipped, $5 \cdot 0 \pm 0 \cdot 02$ cm. long and $1 \cdot 6 \pm 0 \cdot 04$ cm. wide ; free tepal translucent white, $2 \cdot 7 \pm 0 \cdot 05$ cm. long and $1 \cdot 7 \pm 0 \cdot 03$ cm. wide, with acuminate apex ; free tepal occasionally replaced by a staminode ; stamens $4 \cdot 5 \pm 0 \cdot 02$ cm. long ; style $4 \cdot 5 \pm 0 \cdot 03$ cm. long, pale puplish white.

Fruit bunch : Pendent, to sub-horizontal, lax ; peduncle yellowish green with faint purple pigment and sparse pubescence.

Fruit : $10 \pm 0 \cdot 2$ cm. long and $3 \cdot 7 \pm 0 \cdot 03$ cm. in diameter, circular in cross section, with short pedicel and acuminate apex ; pericarp very thin, about $1 \cdot 5$ mm. ; mustard yellow when ripe ; flesh cream ; mean weight per fruit $2 \pm 0 \cdot 07$ oz.

General : *Suwandel* and *Kolikuttu* are the most popular dessert varieties in Ceylon. *Suwandel* resembles *Kolikuttu* in its extreme susceptibility to bunchy top and in the occasional replacement of the free tepal by a staminode. Moon (1824) mentions both.

27. Wadane kehel

Habit : Stools sparsely, stems slightly inclined to the vertical ; suckers pigmented purple.

Pseudostem : Yellowish green tinged purple, about $2\frac{1}{2}$ metres high at flowering, about 69 cm. in diameter at base.

Leaf sheath : Exposed part yellow tinged purple, with occasional brown-black markings; covered part faint purple.

Petiole : Grape green tinged purple, $43 \pm 0 \cdot 2$ cm. long ; adaxial channel narrowly open ; margin incurved, scarious, purple.

Lamina : Light green, $142 \pm 2 \cdot 4$ cm. long and $48 \pm 0 \cdot 7$ cm. wide, cordate at base, obliquely truncate at apex.

Male bud : May be absent ; ellipsoid when present ; bracts not reaching apex, lifting one at a time, not revolute on fading ; outer surface of bracts dark maroon, pruinose, prominently ribbed ; inner surface acajou red, with shallow transverse corrugations.

Male flowers : About 11 per bract ; compound tepal eugenia red, orange-tipped, $5 \cdot 0 \pm 0 \cdot 03$ cm. long and $1 \cdot 4 \pm 0 \cdot 03$ cm. wide; free tepal $2 \cdot 7 \pm 0 \cdot 07$ cm. long and $2 \cdot 0 \pm 0 \cdot 01$ cm. wide, pale purple, with acuminate apicula ; stamens $5 \cdot 0 \pm 0 \cdot 03$ cm. long, with white filaments ; styles three in number, $4 \cdot 2 \pm 0 \cdot 05$ cm. long, white with yellow stigma.

Fruit bunch : Pendent, lax ; peduncle and rachis glabrous.

Fruit : $12 \pm 0 \cdot 2$ cm. long, $3 \cdot 2 \pm 0 \cdot 4$ cm. in diameter, straight or slightly curved, subcylindrical, with short pedicel ; pericarp thin ; apple green when unripe, pale orange yellow when ripe ; flesh ivory yellow.

General : A rare dessert variety ; succumbs readily to bunchy top.

28. Walsuwandel

Synonyms : Ratahonderawala, Suduhonderawala, Walwanduru.

Habit : Stools moderately, stems slightly inclined to the vertical ; suckers unpigmented.

Pseudostem : Rivage green, about $4\frac{1}{2}$ metres high at flowering, about 22 cm. in diameter at base.

Leaf seath : Unpigmented, with brown-black markings on exposed part.

Petiole : Dark green, $56 \pm 0 \cdot 8$ cm. long ; adaxial channel narrowly open ; margins unpigmented, incurved, not scarious.

Lamina : $171 \pm 2 \cdot 4$ cm. long and $55 \pm 0 \cdot 6$ cm. wide, cordate at base, obliquely truncate at apex ; midrib unpigmented, with sparse bloom on adaxial and profuse bloom on adaxial side.

Male bud : Ellipsoid ; bracts not extending to apex lifting one at a time, markedly revolute on fading ; outer surface of bracts Corinthian purple, prominently ribbed ; inner surface acajou red, transversely corrugated.

Male flowers : About 20 per bract ; compound tepal tinged purple, orange tipped, $4 \cdot 4 \pm 0 \cdot 3$ cm. long and $1 \cdot 2 \pm 0 \cdot 02$ cm. wide ; free tepal translucent white, $2 \cdot 4 \pm 0 \cdot 03$ cm. long and $1 \cdot 2 \pm 0 \cdot 03$ cm. wide, with acute apicula, frequently staminodial ; stamens $3 \cdot 8 \pm 0 \cdot 03$ cm. long, with white filaments ; style $4 \cdot 1 \pm 0 \cdot 03$ cm. long, with sigmoid bend in lower half, white with yellow stigma.

Fruit bunch : Horizontal, compact, with unpigmented, pubescent peduncle.

Fruit : $12 \pm 0 \cdot 1$ cm. long, $3 \cdot 1 \pm 0 \cdot 04$ cm. in diameter, subcylindrical ; pericarp about 2 mm. thick, apple green when unripe, light orange blotched brown when ripe ; flesh ivory yellow ; mean weight per fruit $1 \cdot 6 \pm 0 \cdot 07$ oz.

General : A dessert variety ; Moon (1824) mentions *Walsuwandel*, *Walwanduru* and *Ratahonderawala*, but apparently considers them distinct.

29. Wathupalu

(*Plate II e*)

Synonyms : Ethari, Ilyayenga.

Habit : Stools freely ; suckers unpigmented.

Pseudostem : Grape green tinged with purple, about 3 metres high at flowering, about 19 cm. in diameter at base.

Leaf sheath : Unpigmented. exposed part pruinose with slight brown-black markings.

Petiole : $50 \pm 0 \cdot 6$ cm. long. adaxial channel wide open, with margins erect, not scarious, bordered by a purple line.

Lamina : $182 \pm 6 \cdot 0$ cm. long and $52 \pm 0 \cdot 5$ cm. wide, cordate at base, obliquely truncate at apex, midrib unpigmented, with bloom sparse on adaxial side, profuse on adaxial side.

Male bud : Turbinate ; bracts not extending to apex, lifting one at a time ; outer surface of bracts mars violet, with bloom and pronounced longitudinal ribs ; inner surface vandyke red, transversely corrugated.

Male flowers : About 14 per bract, in two rows ; compound tepal translucent white with 3 purple veins, $4 \cdot 6 \pm 0 \cdot 04$ cm. long, $1 \cdot 7 \pm 0 \cdot 02$ cm. wide, free tepal with obtuse apex, translucent white, $2 \cdot 4 \pm 0 \cdot 02$ cm. long, $1 \cdot 5 \pm 0 \cdot 04$ cm. wide ; stamens $3 \cdot 9 \pm 0 \cdot 03$ cm. long with white filaments ; style $3 \cdot 8 \pm 0 \cdot 04$ cm. long, protrudes slightly beyond stamens, white with orange stigma.

Fruit bunch : Pendent, lax, with somewhat pubescent peduncle and rachis.

Fruit : $11 \pm 0 \cdot 1$ cm. long, $3 \cdot 5 \pm 0 \cdot 05$ cm. in diameter, moderately curved, with long pedicel and blunt apex, somewhat angulate ; pericarp thick, 2–3 mm., lettuce green with black blotches when unripe, mustard yellow when ripe ; flesh ivory ; mean weight per fruit $2 \pm 0 \cdot 1$ oz.

General : A dessert variety, mentioned by Moon (1824).

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LIST OF LITERATURE

Chandraratna, M. F., 1951 .. Origin of cultivated Races of Banana. *Ind. J. Gen. & Pl. Br.* XI

Cheesman, E. E., 1947 and 1948.. Classification of the Bananas—

I. The Genus *Ensete* Horan. *Kew Bull.* 1947, 97.

II. The Genus *Musa* L. *Ibid* 1947, 106.

III. Critical Notes on Species. *Ibid* 1948, 145.

Plate I.– (*a*) Kochchikehel. (*b*) Mondan. (*c*) Randombe.

Plate II.—(*d*) Kithala. (*e*) Wathupalu. (*f*) Binkehel. (*g*) Anamalu,

Plate III.—(*h*) Puwalu. (*i*) Honderawala. (*j*) Suwandel. (*k*) Marathamana.

De Soysa, D. J., 1947 .. Colour Instability in Some Plantain Varieties. *Tropical Agriculturist*, CIII, 38–39.

Howes, F. N., 1928 .. The Banana in Some Tropical Eastern Countries—Its Form and Varieties. *Kew Bull*, 1928, 305–332.

Jacob, K. C., 1934 .. South Indian Bananas. *Madras Agricultural Journal* XXII, 41–57

Moon, A., 1824 .. Catalogue of Ceylon Plants. *Colombo*

Pope, W. T., 1926 .. Banana Culture in Hawaii. *Hawaii Agricultural Station, Bull*, No. 55.

Quisumbing, E., 1919 .. Studies in Philippine Bananas. *Philipp. Agric. Rev.* XII, 1–90.

Ridgway, R., 1912 .. Colour Standards and Colour Nomenclature. *Washington*

Teodoro, N. G., 1915 .. A Preliminary Study of Pnilippine Bananas. *Philipp. Jour. Sci.* ×, Sci. C., 379–418.

Trimen, H., 1898 .. Handbook of the Flora of Ceylon. *London : Dulau & Co.*

APPENDIX

Glossary of Sinhalese and Tamil Terms

Anai .. Elephant. The prefix in *Anamalu* indications large size of fruit.
Alu .. Bloom
Averi .. Hands
Bin .. Ground. The prefix in *Binkehel* refers to the accommodation of the fruit bunch of this dwarf variety in a pit.
Diya .. Watery
Embul .. Sour
Eti, eta .. Seedy
Gal .. Stony
Hamban .. Moorish.
Honarawalu .. Long-clustered (according to Moon, 1824)
Karu .. Black
Kehel, kesel .. Banana
Kochchi .. Cochin
Meegon .. Buffalo. The term indicates large size
Muwanethikehel .. Banana without a male bud
Navari .. Possibly abbreviated from *nama-averi*, meaning " nine-hands "
Poo .. Flower
Ran .. Golden
Randombe .. A place name
Rata .. Foreign
Rath .. Red
Sambel .. Bloom
Sapumal .. Flowers of *sapu*. (*Michelia champacà* L.) The reference is to the resemblance in aroma
Seeni .. Sugar
Sudumuwanethikehel .. Banana with a white (i.e., pruinose) male bud
Suwandel .. Fragrant banana
Thane .. Honey
Wadane .. Wild
Wanduru .. Monkey
Wathupalu .. Soil-exhausting

Soil Potash and its Availability in relation to Potash Manuring of Coconuts*

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THE coconut palm is a potash-loving crop. This view is based on the heavy uptake of potash compared to nitrogen and phosphoric acid by the palm and the predominance of potash in the composition of the various parts of the palm, *e.g.*, husks, water, leaflets, &c.

If the resources of " available " potash in the soil are low or inadequate, manuring with potassic manures should produce a response. On the other hand, if the supply of available potash is sufficiently high to produce a level of potash in the soil to meet the demands of high production, manuring with potash may not produce a response.

The chemistry and mineralogy of soil potash is a highly technical subject, on which there was no clear understanding until the subject was clarified by recent work during the last two decades by the study of clay minerals in the soil.

Our soils are derived from the weathering of gneissic rocks ; in this process the original primary minerals containing potassium such as feldspars and mica, which are present in the original rocks, break down and finally change chemically by the leaching action of water. The great bulk of the soil potassium usually exists in the difficulty available category as feldspar and mica.

Transformation of potassium thus held to more available forms is very slow. In this process the potash is retained in various forms in secondary minerals and finally in the clay fraction. Clay may be described as the salt of a complex weak acid of which the bases are calcium, magnesium, potassium and sodium.

CLAY MINERALS AND POTASH AVAILABILITY

The clay fraction is the seat of mineral fertility in the soil.—It is a colloid but at the same time crystalline. This colloidal material is not of uniform composition and varies for different soils depending on the degree and extent of weathering and the composition of the original rocks from which the clay is derived. The potassium supplying power of the soil for crops and its

* Paper read at the December 1950 Sessions of the Ceylon Association of Science.

durability is essentially a story of colloid chemistry. This ability which is the essence of potassium fertility and its complementary phenomenon response to potash manuring, is dependent primarily on the more or less flexible equilibrium among the " forms " of potassium in the colloid clay.

According to recent work done during the last two decades particularly in America, by the application of X-ray analysis by Hendricks, Ross, Kelley *et al.*, the clay minerals chiefly concerned consist of an isomorphous series of three characteristic types :

(*a*) The Kaolinite Type (1 : 1 Lattice Type). In this type, owing to its molecular structure the colloidal character would seem to be associated rather with the external surfaces than with internal reactions. The typical members of this group are Kaolinite and Hallyosite.

In areas of deep and long continued weathering, especially in the tropics under conditions of high temperatures and high rainfall, and more especially where the parent rock is characterized by alkaline feldspars, kaolinite is formed. This may be the typical mineral in the soil of the low country wet zone.

(*b*) The Hydrated Mica Types (2 : 1 Lattice Type).

This is a less weathered mineral type, represented by illite : which consists of somewhat hydrated potash micas in which increase of hydration is accompanied by decrease of potassium. The dehydrated end member is therefore claimed to be Muscovite.

(*c*) The Montmorillonite or Expanding Lattice Group (2 : 1 Lattice Type). This group has been exhaustively studied by Marshall (1), important members of which are Montmorillonite and beidellite. These occurring in the fine clay fractions, have a high base exchange capacity, and is the typical clay mineral in soils of temperate regions and in many arid zones.

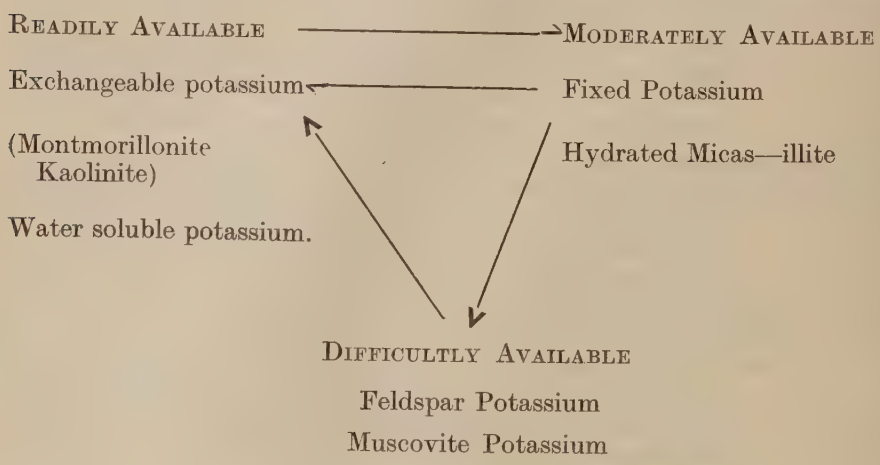
"FORMS OF AVAILABLE POTASH"

Potassium occupies a graded series of positions in these minerals resulting in a gradient in relative ease of removal.

At the more flexible end of this series potassium is attached to the clay mineral in a form which is well known as " exchangeable " or " replaceable " potassium. In this form potassium is bound up loose in the outer kernel of the clay minerals and can be easily taken up by plants by its conversion to water-soluble potash which forms the " soil solution ", feeding plant roots. If on the other hand potassium manures are added to the soil, the K-ion enters the clay by replacing " the exchangeable " calcium and replenishes the stocks of " exchangeable " potash to supply the potash in the soil solution as and when the plant needs. The water-soluble potash and the exchangeable potash are reversibly convertible and this relationship

forms the key to potash availability and potash response. If the original reserves of the exchangeable potash are high, the plant may not respond to added potash.

At the less flexible extreme end the potassium-ion occupies a stable position, deeply buried in the colloid particle (*e.g.*, illite which is allied to the primary rock mineral muscovite or mica), and it is dislodged with great difficulty under field conditions. The following diagram illustrates the equilibria between different potash minerals :—



There are numerous gradations in the status of the potassium used up in relative ease of removal.

Ordinarily 90 per cent. or more of the readily available potassium in soils exists in exchangeable form. The potassium added in plant residues and commercial fertilizers exists almost entirely as water-soluble salts, and when these materials are added most of the potassium contained therein goes into the exchangeable form.

POTASH FIXATION

According to recent work, added potassium which reacts with the clay fraction and enters into the exchangeable form by chemical reaction may revert to non-exchangeable or "fixed" form. This is called "potash fixation" and is said to be brought about mainly by alternate drying and wetting such as occur during droughts and should be of significance under the conditions in which coconuts are grown in Ceylon.

Although the potassium involved in this fixation is much less available than that in the exchangeable form, it is considerably more available than that in the difficultly available form. It may therefore be considered as *moderately available.*

When the supply of exchangeable potassium is drawn upon by cropping, some of the fixed potassium changes over to the exchangeable form. The transformation of exchangeable potassium to the fixed form and back again is a balanced equilibrium reaction. In fact the phenomenon of fixation is of considerable value and provides a reservoir in which potassium is held against leaching but is yet available for crop needs.

POTASH STATUS OF CEYLON SOILS

Unfortunately in Ceylon there has been hardly any work done on these basic points regarding the potash status in Ceylon soils. We have commenced some work on these lines in a study of exchangeable potassium in relation to potash reserves of Ceylon coconut soils and the response to potash manures. At the same time with the co-operation of the Government Mineralogist, the primary minerals in different fractions of some soils we are studying will be determined as we do not have the necessary facilities.

Work on these lines is of fundamental importance and until further data are available on these lines, analytical figures for potash contents such as hydrochloric acid soluble potash and citric acid soluble potash are of little value.

It may be mentioned that in the well known and valuable series of papers by Joachim *et al.* in their studies of "Ceylon Soils", no values for exchangeable potassium are given, except in one isolated case. It is of course conceded that the analytical methods for its determination are time consuming.

This property of "fixation" by which normally exchangeable potassium is rendered non-exchangeable and therefore less readily available to plants was shown by recent work (page 129 Marshall) to be characteristic of clays of the Montmorillonite and Illite groups and is absent from that of the Kaolinite group. One can therefore assume that fixation of added potash would not normally be a problem associated with our low country wet zone coconut soils or the lateritic gravels.

Most coconut soils are not heavy clay soils and would be expected to be normally deficient in potash. This is particularly true of such extreme types as the cinnamon sands and the laterites and lateritic gravels, the former containing a very small amount of clay (the seat of potash fertility) and the latter the residual heavily leached type of soil where most of the bases including potash have been leached out.

The soils at Bandirippuwa Estate may be considered typical of the average coconut soils of the Chilaw District and our $3 \times 3 \times 3$ N.P.K. manurial experiment during a period of 14 years has shown that potash produces a marked response in yield of copra (2).

While in general coconut soils should be expected to respond to potash there may be soils in isolated areas such as the heavier alluvia in certain parts of the Kurunegala District and local formations that may have adequate supplies of available potash that may show no response to potash manuring.

On this point the 3 × 2 × 2 manurial × cultivation experiment at Ratmalagara Estate, 6 miles north-east of Madampe, is of particular interest. Here, among others, 3 levels of potash (0, 1 lb. and 2 lb. K_2O per palm) are compared, but so far no significant response to potash has been obtained during the last 6 years.

Preliminary studies have shown that the Ratmalagara soil, on that area of the estate which comprise this experiment, is comparatively rich in exchangeable potash. It is a heavier red loam compared to the Bandirippuwa soil and in contrast to the latter which contains about 0·02 milligram equivalents exchangeable potash per 100 gms. soil, the Ratmalagara soil contains about 10 times this amount.

POTASH CONTENT OF COCONUT WATER IN RELATION TO AVAILABLE POTASH AND POTASH RESPONSE

The possibility exists of obtaining useful indications of " potassium-supplying power " of soils from analysis of samples of plant tissue taken at suitable stages of growth from crops growing in the field. The fundamental idea behind this method is that the amount of nutrient absorbed by the plant reflects the available amount in the soil. It is evident from the work of many investigators, particularly Hoagland at California and of Wallace at Bristol (both working on orchard crops comparable to a plantation crop like the coconut), that plant tissue content of potassium may be greatly influenced by the nutrient medium and that there is a high correlation between percentage of potassium in the vegetative tissues and the response of the plant to potash manuring.

This technique as applied to the potash content of coconut water is giving hopeful results. Coconut water studies have been carried out with the N.P.K. experiment at Bandirippuwa since 1946 up to the end of 1949 (24 picks) and since this year similar studies have been commenced with the Ratmalagara Experiment since January this year.

Some of you may recollect the preliminary work on this subject which was presented at the 1947 sessions of our section in a paper entitled " The potash content of coconut water as a guide to the manuring of coconut palms " (3). Further data have been accumulated since then and are of great interest. The results given below are revealing.

K_2O in nut water (gms. per litre)

	K_0	K_1	K_2
Ratmalagara	2·26 ..	2·29 ..	2·39
Bandirippuwa	1·00 ..	1·49 ..	2·09

The corresponding yield data (lb. copra/acre) are given below :

Ratmalagara	1,438 ..	1,466 ..	1,589
Bandirippuwa	891 ..	1,292 ..	1,437

It will be seen that there is a high correlation between the yield and the potash content of the coconut water.

At Bandirippuwa the potash content of the water rises *pari passu* with the potash content of the soil and provides an index (*a*) of the potash status of the soil and (*b*) of expected yields.

At Bandirippuwa the yield of copra increases significantly with potash manuring. From 891 lb. copra per acre per annum for the plots without potash (K_0) the yield increases to 1,292 lb. where the palms receive 0·75 lb. K_2O per palm (K_1) and 1,437 lb. where 1·50 lb. per plam are applied (K_2). There is a corresponding increase in the potash in the water from 1 gm. per litre to 1·49 gms. and 2·09 gms. an increase of about 0·5 gms. K_2O per litre for each addition of potash manure.

No such differences in yield or potash content of water are found at Ratmalagara in spite of the fact that the rates of application of potash are higher (1 lb. and 2 lb. K_2O per palm).

A possible explanation is that the reserves of available potash in the form of exchangeable potash are so high that added potash makes no effect on yield.

It is hoped that this " Biological " method (which is very quick and adaptable as a routine method) will be a reliable guidance for studying potash status of coconut soils in contrast to time consuming " soil analysis " or leaf analysis. While leaf analysis of bearing palms involves difficulties of sampling, the use of coconut water has advantages as a routine diagnostic method, particularly in view of the fact that the water does not need preliminary treatment to remove sugars for the determination of potash by the gravimetric method, as shown by critical studies carried out by us.

LUXURY CONSUMPTION OF POTASH

There is another aspect of potash manuring in relation to potash response that is of considerable scientific and economic value. It was shown by Hoagland that beyond a certain critical level, applied potash is absorbed by the plant and accumulates in the tissues and at this stage there is no corresponding increase in yield. This is designated " luxury consumption " by Hoagland (6). In our Bandirippuwa experiment at the upper levels of manuring used by us (K_2–1·5 lb., K_2O per palm) this does not seem to occur as the rising potash content of the water runs more or less parallel with yield curves. On the Ratmalagara soil the addition of K_2–2 lb. K_2O per palm even though it does not produce significant yield increase, does not produce any increase in potash content of the water compared to K_0. This can be easily explained by comparing the relative contributions of exchangeable potassium and added potash to the potash status of the soil.

There is evidence to show that the soil at Ratmalagara is exceptional, as it appears to be a very immature soil, and certain studies on its clay fraction as well as mineralogical analysis that have been proposed should confirm this.

2——J. N. B 9070 (7/51)

Among other typical coconut soils where the potash response may be small the following are likely :

(*a*) The red soils of the Matale-Wahakotte, and Wahakotte-Kurunegala area (*e.g.*, Melsiripura) derived from dolomitic limestone).

(*b*) Heavy alluvial deposits of the Kurunegala-Mawatagama area.

(*c*) Chocolate loams of Marawila.

SUB-SOILS AND SOIL POTASH

These soils give high yields of 4,000 nuts/acre *without manuring* by cultivation alone if rainfall is favourable. However, except in (*a*) and (*b*) the potash content of the soil (as shown by Joachim's analysis published in the *Tropical Agriculturist* (4) (5) is comparatively low (on a per cent. basis); but as the soils are very deep, sometimes, up to 30 or 40 feet roots have an extensive area to scour for plant food, so that, although the percentage content of available potash is small, the nett quantity available is considerable. Coconut roots have been found at great depths on these soils.

We know that on these soils, unlike on shallow soils with impermeable subsoils such as laterites and lateritic gravels, coconut roots penetrate to great depths. It is unfortunate that Sampson (7) has classified coconut roots into " feeding roots " and " water roots ". Such a classification is obviously illogical on elementary physiological grounds. Is it likely that there is a mechanism in the subsoil roots which enables them to take up the needed water and to exclude the necessary plant nutrients ?

There arise difficulties when we adopt chemical procedures for estimating the fertility of soils when we confine our attention almost exclusively to efforts to measure the nutrient supply in terms of surface soils—the so-called 9 inches of " top soil ". We thereby measure merely the *Intensity Factor* of soil fertility and disregard the *Capacity Factor*. The actual capacity should be the product of the Intensity Factor, expressed say, as weight of nutrient available per unit weight of soil by a Capacity Factor, which will take into account the actual volume or weight of soil which the crop will be able to exploit.

There are almost unlimited reserves of practically all nutrients, major, minor and trace, except nitrogen, which lie beneath the surface soil which adequate cultivation, particularly drainage to provide the necessary aeration for root development, can help to exploit ; of these potash is of major importance to the coconut palm.

To study these problems satisfactorily several $3 \times 3 \times 3$ NPK experiments of the type laid down at Bandirippuwa are necessary, on which corresponding soil studies and complementary plant tissue analyses (*e.g.*, coconut water) can be made.

REFERENCES

1. Marshall, C. E.—(1939). The Colloid chemistry of the Silicate Minerals. Academic Press Inc., Publishers, New York.
2. Salgado, M. L. M.—(1946). Recent Studies on the Manuring of Coconuts in Ceylon. Trop. Agric. Vol. 102. (Issued as Bulletin No. 6, Coconut Research Scheme, Ceylon.)
3. Salgado, M. L. M.—(1948). The potash content of coconut water as a guide to manuring of coconut palms. Proc. Ceylon Assoc. Sci. (4th Ann. Sess.) Pt. 2, 7–8.
4. Joachim, A. W. R., and Panditteseker a (1935). Studies in Ceylon Soils IV. The light sandy soils and the red dry zone and semi humid soils. Trop. Agric. Vol. 85, 21–29.
5. Joachim, A. W. R., and Kandiah, S.—(1937). The Characteristics of further important soil groups. ibid. Vol. 88, 12–25.
6. Hoagland, D. R.—(1944). Inorganic Nutrition of Plants (p. 167) Walham Mass. USA).
7. Sampson, H. C.—(1923). The Coconut Palm. John Bate Sons & Daniellson, Ltd.

First Case of Swine Erysipelas in Ceylon

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SWINE erysipelas is an acute infectious septicaemic disease of pigs. It is caused by an organism known as Erysipelothrix rhusiopathiae. The disease is widespread in Western countries. In Ceylon, however, it has not so far been reported. This note records the detection of the first case of the disease here. On October 1, 1950, a sow from an Estate in Kandy District was brought in a lorry by the estate dispenser to the Veterinary Hospital attached to this laboratory. Examination of the animal revealed well defined, somewhat raised rhomboidal and square shaped, dark red and purplish patches almost all over the body ; there was conjunctivitis, dullness and loss of appetite. The animal moved with great difficulty only when persuaded. On inquiry, the dispenser stated that another sow had developed similar symptoms a week or ten days previously, and had recovered ; but was having paresis of the hind quarters after recovery. These symptoms led to the suspicion that the disease was Swine erysipelas.

MICROSCOPICAL EXAMINATION

A blood film taken from the ear and stained by Leishman's stain showed the presence of slender rod shaped organisms.

CULTURAL TESTS

From a loopful of blood, primary cultures were made on blood agar and in Robertson's media. Examination after 20 hours of incubation showed minute, pin-point, dew-drop like colonies, with a zone of alpha haemolysis around them on blood agar plates. A pure culture of the organism was obtained by subculture. In this culture, the colonies were raised and smooth having a convex surface and were about 0·2 to 0·4 mm. in diameter. Prolonged incubation did not increase the size of the colonies but the zone of haemolysis became a bit larger. The organism produced acid in lactose, slightly in glucose and mannite, and no change in maltose, sucrose, dulcite, inulin, arabinose, raffinose, xylose, salicin and litmus milk. M.R. and V.P. tests were negative. The growth in nutrient agar was not luxuriant and there was no growth on potato. In nutrient broth there was cloudiness and turbidity which settled down as a greyish sediment at the bottom of the tube on the third day when the culture was left at room temperature.

Microscopical examination of the culture showed the organism to be Gram positive, slender and straight. Some were slightly curved and measured 1–2 microns in length and 0·2 to 0·4 microns in width. It was non-motile and did not form spores.

BIOLOGICAL TESTS

A mouse was injected subcutaneously with 0·1 c.c. of a twenty-hour old broth culture, a pigeon with 0·2 c.c. and a rabbit and a guinea pig with 0·3 c.c. each. Excepting the guinea pig, all the animals died within 3 to 5 days of inoculation. The mouse developed conjunctivitis, the eyelids glued together with a muco-purulent discharge, and the back arched, before death. On post-mortem examination the cutaneous blood vessels were found to be congested and the spleen slightly enlarged. Organisms resembling those in the culture originally injected were found in large numbers in the blood smear, particularly in the leucocytes. The pigeon developed paralysis and was prostrate the day before its death. Blood films taken from the bird showed the presence of the organism in large numbers. The organism was also recovered from the dead rabbit. Blood taken from each of the three dead animals was cultured and the organism recovered in each case was identified as Erysipelothrix rhusiopathiae. A culture of the organism was sent to the Director, Veterinary Laboratory, Ministry of Agriculture and Fisheries, Weybridge, England, who confirmed our identification of the organism as Erysipelothrix rhusiopathiae.

TREATMENT

The sick sow was treated with penicillin. 200,000 units were administered daily for three days. The skin lesions began to heal, but as the animal had a fracture on its left forelimb, it developed complications and died after a fortnight of its admission to the hospital. As the other contacts in the estate were developing the disease, the dispenser of the estate was advised to give 200,000 units of penicillin to each of the affected animals daily, for five days from the date of the onset of symptoms. All the affected animals recovered.

SEARCH FOR THE SOURCE OF INFECTION

The estate was visited in early December to trace the source of infection and to see the condition of the recovered animals. It was learnt that within 2 months the disease had run through the whole herd of 22 pigs in the sty, excepting the stud boar which was housed in a corner pen. None of the affected animals had died. It was interesting to note that a pregnant sow which manifested the symptoms of the disease five days prior to farrowing did not give the infection to its five piglings, though it had unhealed lesions on the body for over a fortnight. This sow was the last animal to develop the disease in the sty. Except for the sow which developed the disease first, the other animals which recovered were in good condition. The piglings were one month old at the time of infection and were doing very well.

The Manager of the estate said that no new animals had been introduced into any of his divisions for at least 18 months before the appearance of the disease in the division. Food that was fed to the pigs could not be suspected as a possible source of infection as anything that was fed to the animals was grown on the estate and the coconut poonac came from Colombo. Again though there were several divisions in the estate where pigs were reared and fed with the same food, the outbreak had occurred only in one division. The pig keeper who had an experience of over twenty years in rearing pigs stated that he had never come across this disease in the animals before. Cows which were housed adjoining to the sty in the same building appeared to be in normal health. In view of these facts it is not possible to establish the source of infection and the manner in which the disease had spread. Most probably the disease may have been introduced into the estate long ago in a mild, imperceptible form by an imported animal, and the organism gradually increased its virulence to give rise to the urticarial form of infection.

Rice in Java

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JAVANESE, in common with half the world's people, use rice as their staple food. During the pre-war period, 1934–38, Java (including Madura) had a paddy acreage of 9·4 million acres, and a paddy production of 6·1 million metric tons. Political unrest in the post-war period has induced a slight shrinkage in area and output; in 1947/48, 8·9 million acres produced 5·1 million metric tons. These figures for area and output represent 4·2 per cent. and 3·6 per cent. respectively, of the world totals for 1947/48. Acre yields have dropped since the outbreak of World War II, from 29·5 bushels per acre in the 1934–38 period, to 27·8 bushels per acre in 1947.

Rice growing in Java dates back to its introduction about 1,500 B.C., by settlers from India. The antiquity of the crop explains its rich range of variation. At least 3 types of rice lands can be recognized.

(1) *Tegalans* (uplands), in which *gogo* rice rotates regularly with other arable crops like groundnut, soybean, maize, cassava, and tobacco, and chenas in which *ladang* rice is grown.

(2) Unirrigable, asweddumized *sawahs* (lowlands) which are completely rainfed.

(3) Irrigable *sawahs* in which other supplies of water supplement rain.

The third type of land is the most extensive—it constitutes 90 per cent. of the rice acreage—, is completely transplanted, and is the least liable to disease, damage, and cultivation hazards. Rice often rotates with crops like groundnuts and cassava even on irrigated and on purely rain-fed *sawahs*. The system of cultivation on purely rainfed *sawahs* is called *gogorantjah*, and is identical with the *manawari* cultivation in the Northern and Eastern Provinces of Ceylon. The *gogo* rices on *tegalans* are comparable with the *godawis* on Ceylon *owitas*, and the *ladang* rices with the *elwis* of this country. The acreage of upland rice in Java is unlikely to exceed 900,000 acres.

TYPES OF RICE

In addition to the usual non-glutinous varieties, a small amount of glutinous rice* (*Ketan*) is grown for use in confectionery. Occasionally, a field of non-glutinous rice may have a border of a glutinous variety which is cut first and is used in harvest rituals.

In Indonesia, two groups of rice varieties are recognized on the basis of morphological and physiological characters, viz., *bulu* and *tjereh* varieties. The characters differentiating the two groups are tablulated below :

	Character	*Bulu Varieties*	*Tjereh Varieties*
1.	Awns	present	absent
2.	Lodging	do not lodge	lodge
3.	Shattering	do not shatter	shatter badly
4.	Reaction to soil fertility	demands high fertility	tolerant of low fertility and lodges on fertile soils
5.	Tillering	sparse	profuse
6.	Photoperiodic reaction	insensitive	sensitive
7.	Grain size	usually large	usually small
8.	Grain shape	usually bold	often long and narrow
9.	Pubescence on inner glumes	usually somewhat long	usually short
10.	Lamina	usually broad and stiff	usually narrow and flaccid
11.	Pubescence on lamina	usually sparse and rough	usually thick and soft
12.	Culm	usually thick	thin or moderately thick
13.	Percentage natural crossing	usually high–may rise to 15 per cent.	low—usually under one per cent.

Unbearded *bulu* varieties occasionally occur and are called *gundils*. Natural crossings between *tjerehs* and *bulus* present curious features. When a *tjereh* is the female parent, natural crossing can be as low as two per cent. In the reciprocal cross, the percentage can rise to twelve.

Crosses between *bulus* and *tjerehs* show a high degree of sterility in the F_1 generation, and plant breeders in Java have identified *bulus* with *japonica* forms, and *tjerehs* with *indicas*. That *tjerehs* are *indicas* is not seriously disputed. *Bulus*, on the other hand, apart from their breeding behaviour and their resistance to lodging and shattering, have little in common with *japonicas*.

In Java, *bulus* and *tjerehs* cover comparable extents. The position in the other islands that compose Indonesia is rather different ; Borneo, for instance, grows only *tjerehs*, and Bali only *bulus*.

RICE IMPROVEMENT

In the early days, lack of appreciation of the high degree of local specialisation of rice resulted in the same mistakes in Java as in Ceylon. Selection work, which had originally been centralized at Buitenzorg (now

* The endosperm of glutinous rice contains dextrin which colours purplish red in an iodine solution (3 gm. iodine and 10 gm. potassium iodide in a litre of water) ; the starch endosperm of non-glutinous rices colours blue.

re-named Bogor), had proved unprofitable, and was subsequently distributed over several stations representative of rice tracts. Numerous pure-lines produced by straight selection are now on issue. Particular mention may be made of the pure-lines *Brondol putih* 277, *Baok*, *Benong* 130, *Djambu* 129, and *Gropak gedeh* 97, all of which resist lodging, tiller freely and yield well. The most striking achievements have, however, been the results of, not straight selection, but hybridisation. The most fruitful cross was one between *Lati Sail*, an Assam variety, and *Tjina*, which, as its name suggests, appears to have come from China. The famed 40-C selections are all derivatives of the *Tjina X Lati Sail* cross. The most valuable of the 40-C selections are *Bengawan*, *Fadjar*, *Intan*, *Peta*, *Salak* and *Tjahaja*, all of which resist lodging, shattering, and the disease *mentek*. All the pure-lines mentioned above are included in the collection of 27 rices brought by me from Java. Some of these Java rices have already been crossed with Ceylon pure-lines at Peradeniya. In Java, in addition to pure-lines derived from straight selection and hybridization, " purified populations " of village varieties are issued to growers.

Civil disturbances have prevented the smooth functioning of the Government machinery for seed multiplication and issue. At the best of times, however, the Javanese peasant has shown a decided preference for his own nondescript seed. In some of the fields I visited, the varieties that composed the crop were present in proportions that suggested that the mixture, as in the case of the Ceylon *Muppangan*, was probably deliberate.

SEASONS

I have seen the operations of nursery sowing, transplanting, weeding, and harvesting proceed simultaneously in the same tract. The west monsoon is, however, the major rice season, and much of the harvesting is done in the months of May and June. The duration of the varieties grown ranges from 130 to 240 days. The late varieties are grown in areas that carry only one rice crop a year. In certain parts of Java, however, the land is cropped in rice thrice in two years or twice in a single year. In the latter instance, a crop is taken in the east-monsoon (*gadu*) season as well ; this crop is harvested during the period, September-November. A 160-day variety is usually grown in the east-monsoon season, followed as a rule by a 130-day variety.

CULTURAL METHODS

Irrigable *sawahs* are invariably transplanted. Whole panicles are sown at the rate of 400 lb. per acre, in seed beds about two yards wide, and extending the entire width of the bunded terrace. Narrow drains separating beds permit irrigation. Water covers the beds only after the seedlings are established, and thereafter the water level is raised gradually to a maximum of about four inches. Seedlings are usually transplanted at an age which would be considered somewhat advanced in Ceylon, e.g., 40–45 days old seedlings for 165-day varieties. The Japanese had during their war-time

occupation of Java, indicated to Javanese peasants that it was the physiological age of the seedling that mattered—not its chronological age— and that the six-leaf stage was the most suitable for transplanting. This practice of reckoning physiological age by leaf number disappeared with the departure of the Japs. Except for the rare application of goat dung the nurseries receive no manure.

While the seedlings are growing in the nurseries, the fields are ploughed (1–4 times), harrowed (1–4 times) and levelled. Seedlings are transplanted, three to four per point, in points spaced eight in. apart. Transplanting depth is about two in. The crop receives one weeding about $1\frac{1}{2}$–2 months after transplanting ; the weeds are trampled under.

A small knife (*ani-ani*) is used for harvesting individual panicles which are removed with 10-15 in. of stalk. The ratio of grain to stalk-paddy harvested is 80–85 per cent. *Tjereh* varieties are threshed under foot in the field. *Bulus* are tied in bundles weighing about ten lb. each, transported to the cultivator's home, and threshed at leisure with a pestle and mortar. Buffaloes are not used for threshing either *bulus* or *tjerehs*.

Systems of share tenancy similar to those in Ceylon, obtain in Java. The cultivator pays the women who assist in transplanting, weeding, and harvesting, one-fifth part of the produce. If the assistance is only in harvesting, the payment is one-tenth of the produce. The cultivator then sets aside his seed paddy for the next season, and the balance of the produce is shared equally by landlord and tenant.

LABOUR REQUIREMENTS

In Java, preparatory tillage, mending of bunds and irrigation channels, and uprooting of seedlings from nurseries is done by men. Women transplant, weed, and harvest. An acre of nursery transplants twelve acres.

The distribution of labour hours for the various operations is given below :

Operation	*Labour Hours*
First ploughing	30–47
Second ploughing	27–34
First harrowing	12–27
Second harrowing	26–29
Uprooting seedlings	35–46
Transplanting	151–246
Weeding	169–270
Harvesting	221–587

The first ploughing, particularly if it follows a fallow, consumes more labour than the second. It is stated that with an *ani-ani* the harvesting of a good or a poor crop takes longer than that of an average crop. Twice as many labour hours are needed for harvesting with an *ani-ani* than for harvesting with a sickle.

MANURING

In Java, upland rice responds markedly to nitrogenous manuring, but *sawah* rice does not. Failure to secure response to nitrogenous manuring may be due to the existence of alternative sources of nitrogen, e.g., nitrogen-rich silt in irrigation water, nitrogen in rain and nitrogen fixed by bacteria.

In Java, response to phosphate is general. In phosphate-deficient soils, yield increases of 11–22 bushels per acre have been obtained in field experiments, with the application of 100 lb. double superphosphate per acre. Locally occurring rock phosphate has been found satisfactory although it is not as effective, on an equal P_2O_5 basis, as double superphosphate. Cheribon lime phosphate has benefited acid laterites but not calcareous soils in which it is insoluble. Aluminium rock phosphate, on the other hand, is soluble only in a basic medium, and is unsuitable for acid laterites. Whereas double superphosphate is most effective in small applications than in larger and more infrequent applications, with rock phosphate the reverse is true.

The following species have proved satisfactory for green manure in Java :—

Daincha (*Sesbania aculeata*)
Sunnhemp (*Crotalaria juncea*)
Cowpea (*Vigna sinensis*)
Jack Bean (*Canavalia ensiformis*)
Velvet Bean (*Mucuna pruriens*)

These species can produce 5–6 tons green material per acre in 50 days ; this quantity when turned in, adds to each acre of soil, 40–60 lb. N, 7·5–11 lb. P_2O_5 and 45–80 lb. K_2O.

Although the benefits of manuring have been strikingly demonstrated by research workers, most Javanese peasants practise no form of manuring. In certain parts of Indonesia, paddy fields are considered sacred, and may not be defiled by the application of fertilizers.

DISEASES AND PESTS

Diseases and pests are more troublesome in Java than in Ceylon, partly at least on account of the continuous cropping of rice lands in many areas.

" Mentek ", a disease peculiar to Indonesia, is not as damaging as its notoriety suggests. As early as 1901, it had to be attributed to the eelworm, *Tylenchus oryzae*. Subsequent workers, however, considered the disease physiological and the eelworm invasion secondary. In very recent years, opinion has veered round, and the importance of *T. oryzae* has again been recognized. The tillering of infested plants is reduced to about 50 per cent. If the rice crop has been invaded only once, recovery is complete, and infection may even stimulate growth. It is the repetition of invasion that proves damaging.

In the rice fileds of Muara, near Bogor, I was shown a unique and unpleasant disease, *Kresek*. It had been noted for the first time in the 1948–49 monsoon, by Dr. J. Reitsma, who demonstrated that the disease was caused by a bacterium (*Xanthomonas sp.*), but it appears likely that the disease is old and extensive, and had, in the past, been confused with borer troubles. *Kresek* is essentially a trouble of young transplanted seedlings. The oldest leaves in affected plants successively wither, droop and float on the water. The disease may effect kill of the whole plant or of the main culm and a few tillers only. The varieties, *Tjina*, *Bengawan* and *Mas* are extremely susceptible, and *Solo* and *Djalen* resist the disease.

Blast (*Piricularia oryzae* Cav.), Sesame Spot (*Helminthosporium oryzae* Breda de Haan) and Seedling Blight (*Sclerotium Rolfsii* Sacc.) also exist in Java.

White rice moth borer (*Scirpophaga innotata* Walker) is the most damaging of Java's insect pests. It is troublesome at elevations below 6,000 ft., and in areas with a marked dry season. The yellow stem borer (*Schoenobius incertellus* Walker) causes damage resembling and approximating that produced by *S. innotata*. Rice bug (*Leptocorisa acuta*), striped stem borer (Chilo simplex Butler), rice hispa (*Hispa armigera*) and swarming caterpillar (*Spodoptera mauritia* Boisd.) too take their toll.

POSTSCRIPT

Java soils are largely of volcanic origin and rank with the richest in the world. Moreover, in most rice tracts, the water supply is abundant and assured. Apart from eliminating crop hazards, an assured water supply permits good preparatory tillage, transplanting, and crop harrowing. Despite these advantages, the Javanese peasant obtained in 1947 an average acre yield of only 27·8 bushels. Official guesstimates of Ceylon yields are abysmally low, but it appears likely that a statistically satisfactoiy survey will reveal that the Ceylon peasant achieves on his indifferent soils and with his precarious water supply, yields that compare favourably with those in Java. It is conceded that in both countries the gap between precept and practice is deplorably wide, and that in tracts with an assured supply it should be possible even to double existing yields.

ACKNOWLEGEMENTS

I am grateful to the Indonesian Government for making my visit to rice fields in Java possible, and to Dr. G. A. W. Wagenaar and Mr. Siregar who accompanied me, and placed a wealth of accumulated information at my disposal. I have also drawn heavily on the literature listed below.

Literature

Anon, 1949 .. Commodity Series No. II : Rice Bulletin. *Food and Agriculture Organization of the United Nations, Washington, U. S. A.*

Homans, K. A., 1951 .. Green Manuring Problems in Indonesia. *Working Paper No. 4 of the First Meeting of the Fertilizers Working Party, International Rice Commission*

Ling, L., 1951 .. Review of Available Information on Six Major Diseases of Rice *Working Paper No. 6 of the Second Meeting of the Rice Breeders' Working Party, International Rice Commission*

Reitsma, J. & Schure, P. S. J., 1950 Kresek, a Bacterial Disease of Rice. *Contrib. Gen. Agr. Res. Sta. Bogor, No. 117*

Vander Giessen, C. .. Rice Culture in Java and Madura. *Contrib. No. II, Chuo Noozi Sikenzyoo, Bogor*

Vander Meulen, J. G. J. De Rigstselectie in Nederlandsch Indie. *Mededeeling van het Algemeen Proofstation voor den Landbouw No. 52, p. 943*

Wagenaar, G. A. W., 1951 Rice Breeding and Seed Distribution in Indonesia in 1950 *Working Paper No. 8 of the Second Meeting of the Rice Breeders' Working Party, International Rice Commission*

Departmental Notes

(1) From the Botanist and Agricultural Research Divisions

Results of Recent Research on Paddy

(*a*) For transplanted paddy, the optimum spacing of hills is 6 in. by 6 in. for varieties of a sowing-harvest age not exceeding four months, and 7 in. by 7 in. for longer aged varieties. The optimum seedling number is three per hill for varieties of a sowing-harvest age not exceeding four months, and two per hill for longer-aged varieties.

(*b*) With varieties of a sowing-harvest age not exceeding four months, seedling age at transplanting should not exceed three weeks, and with longer-aged varieties, seedling age should not exceed 4–5 weeks.

(*c*) The application to the nursery of superphosphate at the rate of $1\frac{1}{2}$ cwt. per acre is recommended. This application, which amounts to 3 lb. P_2O_5 per acre of transplanted field and costs less than Re. 1·80, represents a remarkably profitable exploitation of phosphatic fertilizer. Significant yield increases ranging from 4–47 per cent. have been obtained with this treatment.

(*d*) Yield increases can be obtained by pre-sowing treatments of seed paddy. For *Vellai Ilankalayan* the treatment consists in soaking seed in water for 6 hours and keeping it tied wet in a gunny for an additional 6 hours.

(*e*) Fertilizer trials in most areas indicate the existence of a nitrogen X phosphate interaction. Applications of 300 lb. sulphate of ammonia per acre alone give, with some varieties, lower yields than smaller applications. The inclusion of phosphate permits the crop to benefit by applications of 300 lb. sulphate of ammonia per acre and over. Similarly, the response to phosphate is often evident only when nitrogen fertilizers are included.

The direct effects of superphosphate invariably exceed those of fused magnesium phosphate, bonemeal, saphos, and hyperphosphate. In the light sandy soils of Unnichchai, Karadianaru, and Paranthan, the residual effects of rock phosphates are greater than their direct effects.

In the light sandy soils of Eastern Province, applications of muriate and sulphate of potash at the rate of 30 lb. K_2O per acre gave yield increases of 20 and 43 per cent. respectively. The superiority of sulphate over muriate suggests the possibility of a sulphur deficiency.

Fertilizer response in *yala* is often more marked than the *maha* season.

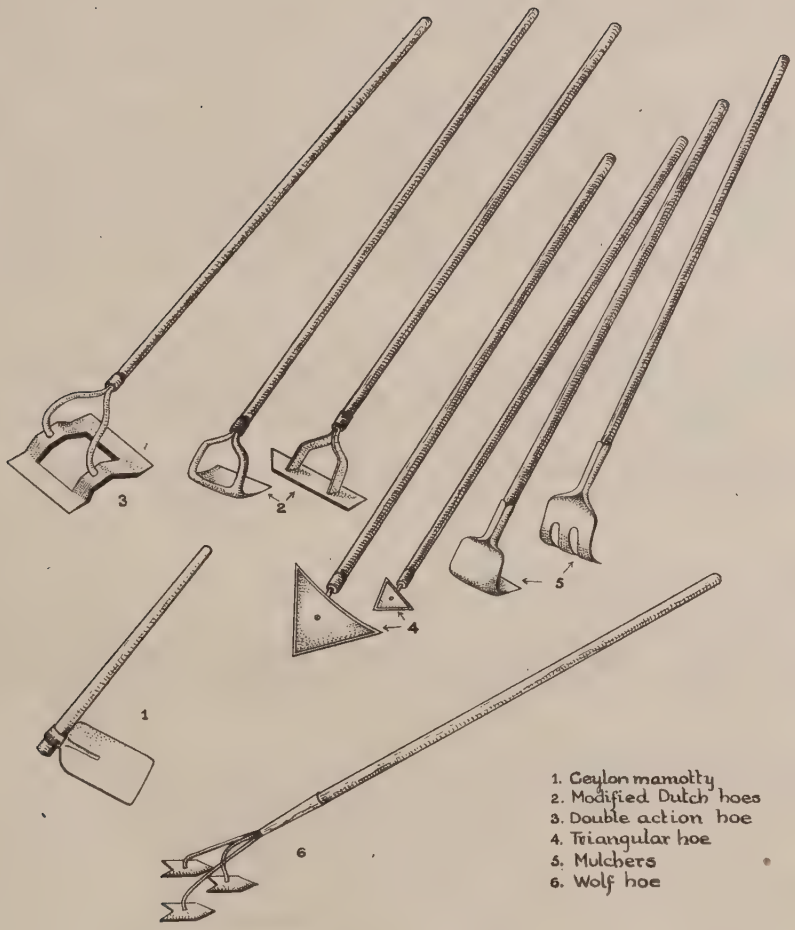
(2) From the School of Agriculture, Peradeniya

(*a*) *Hand Hoes*

The mamotty (Fig. 1) is almost the only type of hand implement used by the peasant in Ceylon, and in the tropics in general, for working the soil. It is essentially a hand hoe with a large, heavy iron blade attached to a wooden handle. There may be some variation in the shape of the blade and the angle of work as well as in the length of the handle, but the general pattern is the same. The chief characteristic of this implement is that it is unnecessarily heavy for most operations for which it is used. The angle of work is generally about 90° and is too wide. The handle is also not sufficiently long. It has become the traditional implement of tropical peoples for almost all work from preparatory tillage in paddy and high land to intercultivation and weeding for crops other than wet land paddy.

The special value of the mamotty lies in turning the soil over in small fields and plots in much the same way that the spade is used in the West, though the action is different. The mamotty is lifted up high and brought down with force on the ground, and when the blade has penetrated some 3 to 4 inches of the soil, it is pulled towards one and a slice of the soil is inverted. In weeding or holing, the implement is raised a few inches high and brought down with the result that the soil is only superficially worked, but all weeds are cut down. By repeatedly working it, the soil can be kept loose and friable.

Owing to the weight of this implement and the short handle, the person using it has perforce to bend down at work. The physical strain becomes considerable. The need for turning out lighter and more efficient hand implements especially for hoeing the soil in gardens and the small plots of the peasant farmer in the tropics, has become urgent. As Mr. Norris E. Dodd, Director of the Food and Agricultural Organization of the United Nations, has pointed out (1) 'millions of the world's farmers need only the simplest tools, to improve their yields and ease the food shortage'. . . 'there are plenty of places, remember, where just a good hoe is an advanced implement'. . . 'Hand cultivators, good hoes, scythes to replace sickles, and other hand tools, useful now to increase food production, can be made in small village shops'. Masefield (2) has also drawn attention to the need for improving hand tools for peasants in the tropics, and he adds that 'a fraction of a foot pound of energy saved on every stroke of the hoe would save more tropical labour than mechanization is likely to achieve in our lifetime'.



1. Ceylon mamotty
2. Modified Dutch hoes
3. Double action hoe
4. Triangular hoe
5. Mulchers
6. Wolf hoe

Printed by Survey Dept. Ceylon, July 1957

With this end in view, a number of different types of hand hoes was constructed at the workshop of the School of Agriculture, Peradeniya, some of which was based on models from abroad, and which after slight modification to suit local requirements and conditions, were found suitable after test. The angle of work in most cases was reduced as it was considered more satisfactory under conditions in Ceylon. The blades of the implements were made self-sharpening by grinding the bevel edge on the side in contact with the ground so that working the implement kept it sharp by the wear resulting from sliding along the ground.

The following are brief descriptions of the types which after trials have given satisfaction. They can all be turned out by any village blacksmith. All the hand hoes now recommended have the great advantage over the mamotty in being light in weight and easy to work. They are all provided with long wooden handles. Those that are briefly described below have replaced the mamotty in intercultivation, weeding, and the mixing of fertilizers in nurseries and the small plots on the School of Agriculture Farm, Peradeniya.'

1. *Dutch hoes.*—There are various types of imported Dutch hoes which vary in the size and shape of the blade, depending on the nature of the work. They are essentially light and easy to handle. The angle of work has been reduced in the two models which are recommended. (Fig. 2.)

2. *Double-action hoe.*—This is also a modification of the Dutch hoe with two blades on either side so that it can be worked in the forward and backward direction. (Fig. 3.)

3. *Triangular hoes.*—The working part of this hoe is a triangular blade fixed to the handle at the centre. It can be used either by moving the pointed end or the horizontal edge. The blades may be of various sizes, the larger being slightly cambered to permit easier working. These hoes are most useful in nursery cultivation and, in particular, for hoeing onions. (Fig. 4.)

4. *Mulchers.*—There are two types—one with a small, strong, and curved blade, and the other with 3–5 prongs. The former is of value in digging and loosening the soil in garden beds, and the other for mixing fertilizers and for stirring the soil lightly. (Fig. 5.)

5. *Wolf hoe.*—This is a type of German hoe for working on hard ground and for removing obstinate weeds. (Fig. 6.)

REFERENCES

1. Dodd, Norris E. 'Hoes and Show How come first'—New York Times Magazine, October 2, 1949. F. A. O. reprint.

2. Masefield, G. B.—The improvement of hand tools for tropical agriculture. World Crops, Vol. 3, No. 2, 1951.

(*b*) *A new forage legume to Ceylon*

Seed of a legume (*Desmodium distortum*) commonly known as beggar weed, was obtained from Guatamala through the courtesy of the office of Foreign Agricultural Relations of the U. S. Department of Agriculture and the U. S. Embassy in Colombo, and was sown in an observation plot at the School of Agriculture Farm, Peradeniya. This legume was found to be rich in protein by the U. S. Department of Agriculture and to be of great value in feeding poultry. It was reported that when chopped and added to poultry rations, it proved to be as good if not better than lucerne. It encouraged rapid, full development of chickens which would otherwise have been stunted before reaching maturity. The plants raised from the seed originally received from Guatamala grew well and have produced sufficient seed for a larger plot to be now planted so that the trials with feeding poultry may now be commenced.

(3) From the Division of Soil Conservation

Danger of landslips from steep hill cultivation

A reconnaissance was undertaken by the Mineralogist and the Soil Conservation Officer in the area of the Kotmale valley which was seriously affected by landslips in the August, 1947, storm. A considerable number of these slips continued to be active and dangerous, but the problem is not confined to Kotmale for similar conditions exist in many parts of the Udahewaheta and Walapane divisions and elsewhere in the hills.

The chief cause of minor landslips appears to be the indiscriminate breaking of steep slopes for the cultivation of manioc and other unirrigated crops. Practically all privately owned holdings in the steep hills are worked in this way and the areas of such cultivation are much greater than is generally realized. Revenue Officers know what crown land is leased for chena, but they have no record of hill side cultivation in private holdings. The standard of cultivation is very poor to start with, and owing to poverty and pressure on the land, such areas are given no respite but continue in cultivation until the soil has gone. One frequently finds patches of such cultivation at the head of an active landslip. A bare slope gives a much heavier run-off than the jungle which it has replaced. Consequently in heavy storms a very great rush of water comes off these cultivated slopes and tends to form a mud-flow which will carry away all obstacles in its path.

The only reliable cure for this type of damage is to close the cultivation on excessively steep slopes and put them under forest or permanent crops such as cardamoms or bamboos. There is a critical angle above which cultivation should not be allowed. For the Kotmale valley this appears to be about 28 degrees of slope. All the fields of a lesser slope should be terraced with frequent stone terrace walls, which will have the effect of making the fields more permanently productive, and will also help with the proper conservation and storage of subsoil moisture, thus reducing the danger of landslips.

(4) From the Veterinary Research Division

(*a*) *Types of Foot and Mouth Disease Virus in Ceylon*

In March, 1950, Foot and Mouth Disease was prevailing at Kadugannawa. Two cartbulls with fresh tongue lesions of the disease were selected and virus material was collected from the non-bursted vesicles. It was suspended in a solution of 50 per cent. glycerinated saline buffered at pH 7·4. The material was sent to the Veterinary Inspector, Chief of the Vaccine Department, Veterinaerdirektoratet, Nyropsgode, 37, Kobenhavn V. Lindholm, Denmark, for type fixing. That laboratory has reported that virus sent from here was identical with their O—strain.

A sample of Foot and Mouth Bivalent (O & A) vaccine prepared at the Denmark Laboratory was sent here for experiments. This vaccine has been tested for safety at this laboratory. The results have so far been very encouraging. Potency tests will be undertaken very shortly.

(*b*) *Experiments with copper prove that goat paralysis is not identical with Swayback in lambs*

Thirty-seven Jamnapari goats were selected at the Livestock Farm, Polonnaruwa, and were divided into 5 lots :—

(*a*) Males at 12 months age.
(*b*) Males at 24 months age.
(*c*) Pregnant she-goats 4–5 years age.
(*d*) She-goats 12–15 months age.
(*e*) Female kids 5–8 months age.

All of these were wormed till the faecal worm egg count was minimum and their haemoglobin percentage was counted, before giving copper. The dose of copper was 1·2 grams copper sulphate dissolved in 5 c.c. of water and was administered orally every week. This experiment was carried out for 4 months in the case of pregnant animals and 6 months with others.

Animals affected with paralysis were also fed with copper to see whether it had any curative effect. The dose was 2 oz. of a solution made by dissolving 1 oz. of copper sulphate in 5 gallons of water, and it was given orally three times a week.

The results of these experiments showed that the feeding of copper could not prevent occurrence of goat paralysis among healthy goats nor could it cause any improvement in the affected animals.

In addition, liver and blood specimens of local healthy goats, paralysed Jamnapari goats, and healthy Jamnapari goats, were sent to Weybridge Laboratory for estimation of copper. This examination revealed that the copper levels of the samples both from healthy and affected animals were not so low as generally associated with Swayback in lambs.

Agricultural Extension Activities

Table I

(1) Statement of total issues of planting material, implements, and livestock during 1950 from Agricultural Divisions of the Department of Agriculture

1. *Seed and Planting Material.*

Seed Paddy Bushels	*Cotton BP 79 Cwt.*	*Kurakkan E 43 Bushels*	*Gingelly B 3 Bushels*	*Selected vegetables Seed lb.*
103,212	891	497	230	3,069

Chili		*Sorghum Bushels*	*Sunnhemp Bushels*	*Cowpea Bushels*	*Coconut Seedlings*
Seedlings Million	*Seed lb.*				
47	11,000	463	311	322	70,263

				Kapok	
Citrus Grafts and Seedlings	*Mango Grafts and Seedlings*	*Jak Seedlings*	*Sapadilla Seedlings*	*Seed lb.*	*Seedlings*
40,591	17,798	8,176	4,222	689	53,440

Coffee Seedlings	*Cassava (Manioc) Cuttings (1000)*	*Sweet Potato Cuttings (1000)*
60,243	54,044	38,500

2. *Livestock.*

Stud Bulls	*Heifer Calves*	*Cows*	*Stud Buffaloes*	*Heifer Buffaloes*	*Stud Goats*	*Stud Boars*	*Piglings*
31	49	10	6	5	14	4	45

Cockbirds	*Chickens*	*Setting Eggs*
737	1,407	42,146

3. *Implements for paddy.*

Iron Ploughs	*Wooden Harrows*
3,913	1,458

(2) Results of Paddy Demonstration Plots

Maha *1949–50 and* Yala *1950*

The results of demonstrations conducted in some of the Agricultural Divisions during 1949–50 and Yala 1950 are shown in the tables below. It will be noted that yield increases are most striking with transplanting alone and more so with transplanting and organic manures. Results with transplanting and artificials are also very good. The responses to the harrowing

of the growing crop are quite encouraging, but weeding alone does not always give satisfactory yield increases. The results of the N. C. D. are shown separately as they relate to treatments which are more appropriate to the local conditions in that Province. The benefits of transplanting, harrowing the crop, ploughing with the mouldboard plough, the use of pure line seed, and cattle manuring are appreciable and very marked in some cases.

Table II

Results of Paddy Demonstration Plots, Maha 1949-50

(1) *Transplanting Alone*

Division	*No. of Plots*	*Yields in Bushels Per Acre*		
		Control b/a	*Treated b/a*	*Increase Per Cent.*
1. North-Western	32	31·1	55·8	77
2. Northern	7	23·3	40·3	73
3. Eastern	5	24·4	51·2	108
4. Sabaragamuwa	17	19·1	30·8	63
5. Western	100	34·1	54·2	59
6. Uva	530	26·5	48·8	84
7. Central	—	—	—	—
Yala 1950				
1. Eastern	—	—	—	—
2. Southern	26	29·6	39·3	33
3. Trincomalee	8	37·5	52·8	41
4. Uva	406	28·1	52·8	88
5. Western	120	35·0	58·0	66
6. Central	—	—	—	—

(2) *Transplanting Plus Fertilizers*

Division	*No. of Plots*	*Yields in Bushels Per Acre*		
		Control	*Treated*	*Increase Per Cent.*
1. North-Western	—	—	—	—
2. Northern	6	30·8	56·9	85
3. Eastern	29	42·9	62·3	45*
4. Sabaragamuwa	—	—	—	—
5. Western	—	—	—	—
6. Uva	60	24·2	52·3	116
7. Central	—	—	—	—
Yala 1950				
1. Eastern	4	27·8	47·8	72
2. Southern	26	30·9	63·5	106
3. Trincomalee	8	37·5	61·1	63
4. Uva	—	—	—	—
5. Western	46	29·2	43·0	47*
6. Central	19	41·9	63·7	52

* Fertilizers alone.

(3) *Transplanting Plus Green Manure or Compost or Cattle Manure*

Division	*No. of Plots*	*Control*	*Treated*	*Increase Per Cent.*
1. North-Western	15	27·0	48·0	78
2. Northern	13	33·4	59·4	78
3. Eastern	4	22·8	53·9	136
4. Sabaragamuwa	3	22·2	56·0	150
5. Western	—	—	—	—
6. Uva	24	29·8	52·1	75
7. Central	—	—	—	—
Yala 1950				
1. Eastern	5	23·7	30·5	29
2. Southern	15	59·9	100·8	68
3. Trincomalee	8	37·5	56·7	51
4. Uva	64	23·3	52·4	115
5. Western	—	—	—	—
6. Central	7	35·7	59·7	55

(4) *Harrowing the Standing Crop*

Division	*No. of Plots*	*Control*	*Treated*	*Increase Per Cent.*
1. North-Western	7	24·7	48·7	96
2. Northern	11	24·8	40·1	62
3. Eastern	20	29·8	35·6	19
4. Sabaragamuwa	32	29·6	43·0	45
5. Western	47	23·9	35·5	49
6. Uva	—	—	—	—
7. Central	—	—	—	—
Yala 1950				
1. Eastern	79	30·9	39·9	29
2. Southern	17	32·3	43·3	34
3. Trincomalee	8	37·5	48·1	28
4. Uva	10	28·3	40·0	41
5. Western	58	31·1	41·4	34
6. Central	13	44·2	52·2	18

(5) *Weeding Alone*

Division	*No. of Plots*	*Control*	*Treated*	*Increase Per Cent.*
1. North-Western	4	17·5	25·5	44
2. Northern	—	—	—	—
3. Eastern	10	28·0	31·4	12
4. Sabaragamuwa	5	29·6	47·3	60
5. Western	—	—	—	—
6. Uva	11	28·9	32·5	13
7. Central	—	—	—	—
Yala 1950				
1. Eastern	4	14·0	18·8	34
2. Southern	—	—	—	—
3. Trincomalee	—	—	—	—
4. Uva	2	30·0	37·0	23
5. Western	—	—	—	—
6. Central	—	—	—	—

Table III

Demonstrations—Maha 1949-50

North-Central Division

	Treatment	*No. of Plots*	*Average Yield bushels/acre*
1.	Ploughing with the mould-board plough. Transplanting Pure line Seed Cattle Manure (1 ton/acre) ..	87 ..	60
2.	As (1) with harrowing of the growing crop instead of transplanting	82 ..	45
3.	As (2) omitting cattle manure	79 ..	34·5
4.	Broadcasting and N. C. P. village practice	108 ..	20·5

Meetings, Conferences, &c.

PROCEEDINGS OF THE NINTH MEETING OF THE CENTRAL BOARD OF AGRICULTURE HELD IN THE BOARD ROOM AT THE ROYAL BOTANIC GARDENS, PERADENIYA, ON 19TH MARCH, 1951, AT 2 P.M.

Dr. A. W. R. Joachim (Director of Agriculture) presided and the following were present :— Mr. C. N. E. J. de Mel (Deputy Director of Agriculture) ; Mr. T. M. Z. Mahamooth (Deputy Director (Animal Husbandry)) ; Dr. W. R. C. Paul (Assistant Director (Technical)) ; Mr. Chas. A. M. de Silva (Vice-Chairman, C.B.A.) ; Dr. M. F. Chandraratne (Botanist and Senior Research Officer) ; Mr. S. L. Bandara Dharmakirti, J.P. ; Mr. U. B. Dedigama, R.M. ; Mr. D. B. Ellepola (Acting Director, Rural Development) ; Major E. C. de Fonseka, M.B.E., E.D. ; Mr. Marcus S. Rockwood ; Mudaliyar N. M. Abulcassim Maraikar ; Mr. E. Muttukumaru ; Senator Justin Kotalawala: Senator R. Singleton Salmon (Deputy Chairman, Planters' Association of Ceylon) ; Senator C. Wijesinghe ; Mr. W. P. A. Wickremasinghe, M.P.; Mr. A. Hensman ; T. B. Pohiliyadda Dissawa, M.P., J.P. ; Mr. W. M. Cumaraswamy ; Mr. A. Perumynar ; Mr. J. A. de Silva (Conservator of Forests) ; Dissawa S. A. I. Elapata ; Mr. R. B. Thalakada (Assistant Registrar, Co-operative Societies) representing the R. C. S. ; Mr. E. Abeyratne (Agricultural Research Officer, Maha Illuppalama) ; A. E. Madawala Dissawa ; Mr. C. Amaratunga (Assistant Commissioner for Development of Marketing) ; Rev. Fr. L. W. Wickremasinghe ; Gate Mudaliyar N. Wickremaratne ; Mr. A. L. Johnpulle (Divisional Agricultural Officer, Uva) ; Mr. H. Abeyagoonasekera ; and Mr. R. L. Arnolda, C.C.S. (Secretary, Central Board of Agriculture).

The following visitors were also present :—Mr. J. M. Thomason (Agricultural Adviser to the Ceylon Government) ; Professor E. A. Hardy (Dry Farming Expert) ; Dr. C. Van Dillewijn (Sugar-cane Expert) ; Mr. A. Decamps (Forestry Expert).

Letters and telegrams regretting inability to attend the meeting were received from the following :—Hon. Mr. H. W. Amarasuriya (Minister of Commerce & Trade) ; Mr. Thomas Amarasuriya (Chairman, Low-country Products Association) ; Director, Coconut Research Scheme ; Director, Rubber Research Scheme ; Mr. S. Sivapalan, M.P. ; Sir Wilfred de Soysa ; Mr. K. W. Devanayagam ; Registrar of Co-operative Societies ; Bulankulama Dissawa, J. P., U.M., M.P. ; Mr. P. B. Bandaranayake ; Mr. U. B. Unamboowe, Sir James P. Obeysekera, Director of Irrigation and Acting Director of Industries.

1. CONFIRMATION OF THE MINUTES OF THE LAST MEETING

The minutes of the 8th meeting of the Central Board of Agriculture were unanimously confirmed as correct. At this stage, however, Mr. A. M. Clement Dias complained that the stenographer had " not written the minutes properly. "

Senator Singleton Salmon pointed out that the minutes were sent to all members in draft form for any corrections or amendments and therefore there was no reason for complaint.

Mr. Dias stated that he had no time to correct the minutes.

The Chairman explained that compiling minutes of a meeting like the Central Board of Agriculture was no easy matter and that it was difficult to do it to suit every individual taste.

That was why the minutes were sent to every member in draft form for any amendments they desired, and hoped that there would be no complaints in the future.

2. RESOLUTIONS TO BE MOVED

The following resolution which was to be moved by Mr. U. B. Unamboowe was postponed for the next meeting as he was absent due to illness.

" THE CENTRAL BOARD OF AGRICULTURE RECOMMENDS TO GOVERNMENT THAT INVESTIGATIONS BE MADE BY A COMPETENT OFFICER TO FIND OUT WHETHER IT IS POSSIBLE TO DIVERT WATER FROM THE MAHAWELIGANGA AT A SUITABLE POINT TO AUGMENT THE SUPPLY OF WATER IN THE TANKS OF THE MATALE AND ANURADHAPURA DISTRICTS. "

Senator Justin Kotalawala suggested, if the House agreed, that Mr. W. P. A. Wickremasinghe's resolution on the Agenda might be taken up with Mr. Unamboowe's resolution at the next meeting as both resolutions were of a similar nature.

Mr. Wickremasinghe said that he had no objection to postponing his resolution but for the fact that it was a flood protection matter which should be taken in hand immediately.

The Chairman said that there was another difficulty in discussing the resolution that day as the Director of Irrigation who is the most competent officer to deal with the subject was also absent. He added that the Director of Irrigation desired him to inform the Board that his wife was suddenly taken ill and he regretted very much his inability to attend the meeting.

Under those circumstances Mr. Wickremasinghe agreed to postpone his resolution. He added that the Parliamentary Secretary who had also promised to attend the meeting with certain facts and figures was also absent. He however requested that this matter be taken up before next July and the Chairman agreed to this, as the next Board meeting would be held in June.

The next item (3) (*a*) on the agenda was a resolution to be moved by Gate Mudaliyar N. Wickremaratne, and the Chairman read out the resolution :—

" THAT THE BOARD SHALL DISCUSS THE POSSIBILITIES OF A CATTLE INSURANCE SCHEME ON CO-OPERATIVE PRINCIPLES BEGINNING WITH AGRICULTURAL PLOUGH CATTLE AND MILK COWS AND APPOINT A SUB-COMMITTEE OF THE BOARD TO DRAW UP A COMPREHENSIVE SCHEME FOR THE APPROVAL OF THE BOARD AND FINALLY TO BE FORWARDED TO THE MINISTRY OF AGRICULTURE AND LANDS FOR FAVOURABLE CONSIDERATION. "

Gate Mudaliyar N. Wickremaratne :—"This resolution which was now read to you by the Chairman is placed before you for favourable consideration and necessary action. At the last meeting, Gentlemen, you will remember that Senator Kotalawala made a suggestion about cattle insurance. That suggestion encouraged me to send this resolution for the consideration of the Board. Cattle Insurance has been in my mind for a number of years. If you gentlemen will refer to the "Tropical Agriculturist " 1917-1919, you will find two papers read before the then Board of Agriculture on Co-operative Cattle Insurance by me. It was a great encouragement for me to hear that some interest is placed in cattle insurance once again. I therefore thank Senator Kotalawala for making that suggestion. We all know that Senator Kotalawala has experience in Insurance organizations and their working. Therefore it will be a source of help to us if we can know some thing more about the working of Insurance Societies from

Senator Kotalawala. I remember, once before we submitted a report drafted by a Sub-Committee of which Sir Wilfred was Chairman, making suggestions regarding improvement of cattle in this country. In that we made certain suggestions that a scheme of cattle insurance should be introduced. I am sorry that the Registrar of Co-operative Societies is absent and I do not know whether any of his representatives are here. I would be glad in case the representative is here if he would be able to help us in this discussion as we are speaking of Co-operative insurance. Once our worthy Vice-Chairman brought a resolution to limit the speeches of members to 3 minutes or 5 minutes, so that I will not take much of your time in making a long speech because I have also two other resolutions on which I should speak. You know the importance of cattle at the present day and how the cattle population is decreasing. I do not think the cattle population of the Island is sufficient even to plough 1/10th of the fields in the country. Unless we have sufficient cattle for our agriculture we will not be able to carry on our cultivation. In places like Batticaloa, Hingurakgoda and Polonnaruwa we had more cattle than were required but now they are in need of cattle for agriculture. The suggestion I made was to include only plough cattle and milch cattle in this scheme and not to include other cattle found in the country so that it will be convenient to bring only these two kinds of animals under this Co-operative Insurance Scheme at first. This simple idea of insurance is to bring animals of two or three years into the Scheme and the owners pay a small premium annually to the Society till they are 12 or 15 years, and then when the animal is dead the Insurance Society should pay either the full value or at least 75 per cent. of the value of the animal because 25 per cent. may be recovered by the sale of the skin or the carcass. Therefore I suggest that 2 per cent. or 4 per cent. of the value of the animal be recovered by the Society once in 6 months during the harvesting time from the owner and if the animal is lost or dead, the Insurance Society should pay $\frac{3}{4}$ of the value of the animal. Therefore I suggest that Co-operative Societies should be formed for this purpose and there should be Insurance Societies. These Co-operative Societies can form themselves into a federal union and pay a certain subscription to the Union. If this Co-operative Union needs help, then the Government should come to their aid. This is in case the Insurance Society is unable to meet the claims. Suppose we register hundred heads of cattle and the death rate is 2 per cent. or 4 per cent. at the end of the year, there will be more money than what is required to pay compensation. But if the death rate increases and there are heavy claims on the Society, I suggest that Government should come to their rescue. At present very little attention is paid to cattle in villages but if Co-operative Societies are formed for this purpose, Government Veterinary Surgeons or some responsible officer could inspect the cattle and give the people the necessary advice, so that a certain amount of responsibility can be placed on them for keeping the cattle in good health. In short, this is the kind of Insurance Society I propose. I think Senator Kotalawala and some others who are familiar with this subject could direct the formation of these Insurance Societies and for this purpose I suggest that a Sub-Committee should be appointed by the Board to collect evidence and go into details and submit a report to the Board at a later date. I hope someone will second this resolution so that this may be discussed by the Board."

Mr. W. M. Cumaraswamy in seconding this resolution said that if this Scheme materializes, it will serve a very valuable purpose particularly in the Low-country areas. He felt that this would be especially valuable for coconut planters who depended entirely on cattle manure for their estates. In the Dry Zone where there was no continuous rain artificial manure could not be profitably used as the manurial value could not be absorbed by the dry soil. Especially in the North, small-holders could not afford to keep motor vehicles for transporting their produce, so that bullock transport has become popular. The Scheme would help cultivators whose agricultural advancement has suffered due to lack of good draught bulls.

He knew from experience that in a dry place like Jaffna the cost of milch cows is very much more than in Colombo or Kandy. A Hatton cow costs on an average, 25% to 30% more than in Colombo or Kandy owing to transport and the maintenance costs were also more. He said " There is no direct access to cattle food from India or any other place. In the matter of milk the cow gives the least quantity of milk in a place where you need the most amount of milk. So that all these things put together will show that the people in the Low-country invest the most and realize the least, especially in the matter of maintaining milch cows. In such circumstances people will find great relief if this Cattle Insurance Scheme were to materialize. I find that many resolutions passed here are not implemented. Major Fonseka's resolution about a Milk Board was dicussed here and if Government implements that resolution it will be a great help to the country and I am sure the Co-operative Department will put it through very well. At present there are Insurance Companies that register horses and not cattle. I hope the Government will take steps to promote cattle insurance for the common good of the country. "

Senator Justin Kotalawala :—" Gate Mudaliyar Wickremaratne expressed a desire that I should also take part in this discussion. I have not read very much with regard to how cattle insurance is being done in other countries, so that I have no concrete proposals. But on general principles the first thing would be, as in the case of motor insurance, to give each insured animal a registered number. With regard to cattle the first thing would be, I think, for the Government to take steps to have places for registration of cattle like a Kachcheri or some such place where persons could go and register their cattle. The owner should give a description of the animal and a registration certificate would be issued. It would then, I suppose, be possible even for private Insurance Companies to undertake insurance because Co-operative Insurance has not yet been started. The rate of premia would be based on production of milk and the value of the animal. Some ratio could be worked out for the payment of the premium. When an animal dies, just as in the case of life insurance, you get a certificate of death from the Headman of the area or from the Veterinary Surgeon of the area. I was told that the intention of the Department is to recruit 100 Veterinary Surgeons so that if you have got a certificate of Insurance and if the Veterinary Surgeon certifies the death, I do feel that this Scheme is workable in this country as in other countries provided the owner gets his cattle registered. Payment of claims at death can be done on a certificate produced by a Veterinary Surgeon.

Mr. T. M. Z. Mahamooth, Deputy Director (Animal Husbandry) commenting on the resolution said that Gate Mudaliyar Wickremaratne had mentioned two classes of animals, buffaloes and milch cows. With regard to buffaloes he would like to say that in certain parts of Ceylon, as members are already aware, according to conditions prevailing the buffaloes are used only during the ploughing season and the rest of the time they are let loose into the jungle with a wooden bell hung on their necks so that the owner could look for them when they are wanted. Prior to 1937 branding of cattle was in vogue but after that there was no compulsion for the branding of cattle and now those who wished, got their cattle branded and the others forgot about it. In case this Insurance Scheme is brought in, at the time of checking it will be found that there is every possibility of one animal being substituted by another because the animal cannot be clearly identified and one owner's word would be as good as any other's. It will be very difficult to prove the identity of an animal and that is one reason why Insurance Companies would hesitate to take up insurance of cattle. This Scheme was bound to give a number of difficulties in regard to buffaloes, but in regard to cows there should be no difficulty at all, because milch cows are well looked after and could be easily identified.

With regard to the services of Veterinary Surgeons expected in this Scheme for issuing death certificates, &c., he said that the members were already aware that there was a shortage of

Veterinary Surgeons. He said that there wasn't a sufficient number of Veterinary Surgeons to go round the Societies. In conclusion he said that he envisaged the difficulty of identification of animals in certain remote areas also, in case the Insurance Scheme is introduced.

Major E. C. de Fonseka suggested the tattooing of the ears and branding in case of buffaloes and inquired whether such schemes were not in vogue in other countries.

Mr. Mahamooth, Deputy Director (Animal Husbandry) replied that the tattooing of animals had to be done when they were young and that when they were three or four years old the tattoo marks diappeared. He said that even recently he had received complaints of tattoo marks being indecipherable.

Senator Wijesinghe said that as far as he could see, the greatest obstacle to this Scheme was not the difficulty of identification of cattle but to find people who would pay insurance premia for the type of risk in this country. The premia, he said, would be about 10 per cent. of the value of the animal. Under those circumstances if the Ministry approved of the Scheme and the Co-operative Societies were authorized to cover that type of insurance with the help of underwriters, then there would be few people who were prepared to pay the premia involved.

Mr. W. M. Cumaraswamy said that he did not think that those difficulties could prevent the inauguration of a cattle insurance scheme. He added, " I do not think any Insurance Company insures human beings for less than a thousand rupees so that in the case of cattle they would have thought it was too much to bother for small sums. The problem of identity can be solved in the same way as horses are concerned, if the certificates are really genuine. There is a Veterinary Surgeon at Jaffna for the whole district. If there is a case of Anthrax he is there for a week, so that the services of that Veterinary Surgeon will not be available for any other work. If there is a Rinderpest outbreak the Veterinary Surgeon is not available. Under such circumstances the risk of the owner is very great and all the more reason why people should insure their cattle. "

Mr. R. B. Thalakada, Asst. Registrar of Co-operative Societies, made the following observations :—" We agree that Cattle Insurance is absolutely necessary but there are certain factors in the form of insurance we should bear in mind. As Senator Kotalawala said from his experience, there are certain statistics or requirements we should have, before we embark on this Scheme.

With regard to the question of risk, in Ceylon the rate of risk would differ from place to place. For instance in the North-Central Province the death rate of cattle will be very much higher than in the Central Province, so that it would not be correct to have the same rate for the whole Island. It would have to differ from province to province. One of the most essential statistical requirements, we do not have at present, and that is the rate of death of cattle in Ceylon. "

He read the following extract from " A Study of the Working of Co-operative Societies " issued by O. Paris, M.B.E., B.Sc. (Hort.), Department of Agriculture, Malta :—

> " 133. Mode of Operation. The fees for Veterinary service are usually 1½% of the livestock value but may be as high as 2% in a lightly stocked district. The annual insurance premiums vary from 3% to 6% according to the type of animal and the degree of immunity to disease. Calves below 4 months and cows or horses above 9 years are not admitted. Insurance is renewed annually up to 18 years for a mule, 12 years for a horse, and 15 years for a cow. In the case of illness or death of an animal, the owner must summon the Society's surgeon stationed in the district or a private practitioner if the former is not available. During its history the Society has paid compensation for all diseases and eventualities except losses caused by war, riots, theft, and operation by an outside surgeon or

failure to comply with instructions. Where the animal dies through carelessness or over-feeding, only 50% is paid. For loss of milk 60% compensation is allowed. Normal compensation is 70% though an increase up to 85% may be paid from the Society's profits. Insurance for the full value of an animal is not undertaken because it is wiser that the member should have a financial interest in keeping the animal alive. Meat value is, of course, deducted from the compensation. If it were not, premiums would have to be higher ..... ".

He said that Cattle Insurance Societies were tried in Burma. In 1928 there had been as many as 300 Societies but all of them collapsed and had to be wound up. He added that recently there was a proposal before the Indian Government that simultaneously with the working out of plans for development, the State should foster any organization which was set up for enabling persons of small means to make provision for the future. What was required for the purpose was a Co-operative Society having contact with the masses of people in rural as well as urban areas through various types of co-operative organizations and issuing policies for small sums even below the present limit of Rs. 500.

He also read the following extract from " The Indian Co-operative Review " of January-March, 1947 :—

" 192. The existing conditions are not suitable for entrusting the business of cattle insurance to co-operative societies. The provincial governments should, therefore, make an experiment in that direction on the lines set out in the Report. After sufficient experience has been gained, the question of giving the insurance business a co-operative form should be considered.

When cattle insurance is organized on co-operative lines, arrangements for re-insurance should be made either with the Government or with reinsurance societies organized for the purpose. "

He said that those were recommendations made to the Indian Government as they found that it was not possible to undertake that work without any reliable data and said that the State should undertake the experiment. He said that, however, in Madras there is one such Society which has not done any work as yet. He also added that the Co-operative Wholesale Establishment has now been authorized by Parliament to take up Life Insurance and certain other forms of Insurance but Cattle Insurance has not yet been authorized, but even if it were authorized the Co-operatives would not be able to experiment with public money unless the Government was prepared to initiate the experiment.

Senator Justin Kotalawala :—" That is exactly why I said that private Insurance Companies would not be prepared to take the risk. If there is an epidemic or something like that, and day to day deaths take place, I do not think the Companies would be able to meet the claims. But this is only in case of an epidemic. "

Mr. R. T. Chelliah felt that the formalities to be observed in the case of a death of a bull or a cow would be too much for a poor man and inquired whether it was really worthwhile.

At this stage the Chairman introduced to the Board the personnel of the Food and Agricultural Organization who were also present at the meeting.

Chairman :—" Mr. Thomason comes to us from the U. S. A. He comes in connection with the Point 4 Plan. Then we have Professor Hardy who is the leader of the F. A. O. deputation. He is a Professor in Agriculture and Agricultural Engineering in Sasketchwan and he has come to solve our problems. In addition we have Dr. Dillewijn who is our Sugar-cane Adviser and I

have no doubt, under his direction and guidance we shall certainly make some sugar in the future. Then we have Professor Decamps who has come here to help us in Forestry. Unfortunately we do not have here, our General Manager of Farms who is away at the moment."

Mr. J. M. Thomason, Agricultural Adviser to the Ministry, said that insurance of cattle in the United States was not popular with Insurance Companies because the cost of the animals make it risky. He added that a few high-priced cattle were so insured. In conclusion he said that in the United States, as a general rule, companies did not like this business.

Professor Evan A. Hardy (F. A. O. Adviser on Dry Farming) said that in Canada too the position was exactly the same. There was no private or Government insurance of ordinary livestock. People who owned pure-bred stock insured their animals in private companies and paid a considerable premium.

The Chairman said that if there were no others who would like to contribute he would like to put the motion to the House. He added that it was only a recommendation which would be further considered by a Sub-Committee appointed for the purpose.

The motion was put to the House and carried unanimously.

As mover of the motion Gate Mudaliyar Wickremaratne suggested the following names for the Sub-Committee to consider this matter :—

> Senator Justin Kotalwala, Mr. W. M. Cumarswamy, Rev. Fr. L. W. Wickremasinghe, Mr. A. M. Clement Dias, The Registrar of Co-operative Societies, The Deputy Director (Animal Husbandry), Convener, Gate Mudaliyar Wickremaratne whose name was proposed by another member.

Item 3 (*b*) of the agenda was next taken up for discussion. The following resolution was moved by Gate Mudaliyar Wickremaratne :—

" THAT THE BOARD RECOMMENDS THE ADOPTION OF A CROP INSURANCE SCHEME ON CO-OPERATIVE PRINCIPLES IN THE CASE OF PADDY CULTIVATION IN CEYLON. "

Gate Mudaliyar Wickremaratne continued :—" I do not think you can expect a long speech from me. A few days after I sent this resolution I read in the newspapers that owing to failure of crops in the Dry Zone, Government was going to evolve a Scheme costing 5 million rupees. The crops had failed owing to the existing drought. A few days later I read again in the papers that thousands of acres had been damaged by floods in another part of the country. In the olden days people say that the weather was so regular that it was something like a clock. They can say when the rains would come and when the drought would set in. They based their programmes to suit the weather. But today the weather conditions have changed owing to clearance of forests and jungle land in this country and some say that even things like the Atom Bomb have contributed to the change of weather conditions.

The paddy cultivator depends on the season and he has no other helper. He had the " Panchanga Litha " to guide him but today these almanacs will not help him. I brought in a resolution once that the Government Institution for the forecasting of weather should keep the cultivators informed of the weather conditions, but very seldom do they warn the people of dry weather or wet weather. For the information of those gentlemen here, I might say that I have no professional qualifications but I have the experience for over 40 years and I have travelled throughout the country. Most of you have seen what has happened in the Batticaloa District. There again I gave a warning that before starting a Scheme like that it was

essential to start a scheme of reafforestation. If they had done something like that, the damage in the Gal Oya area would have been less. After losing a crop of paddy, what is the use of relief work in an area like that. The cultivator himself would not get sufficient to recover the loss of his crop. Five million rupees are spent on this relief work. If this 5 million rupees are spent on some sort of Insurance Scheme for crops and some regulations were enforced so as to make it binding on the part of the cultivator to safeguard his crops from damage, a better purpose would have been served. In places like Australia and England there are certain kinds of subsidies. Nothing is subsidized here in Ceylon. Of course Government pays Rs. 8 for a bushel of rice. But a subsidy means that some kind of help must be given to the cultivator and in a number of years when that job is done the subsidy can be removed. Therefore I say that the paddy cultivation should be subsidized in the form of some Crop Insurance Scheme and the Government should be asked to take the responsibility. Therefore instead of wasting money on relief schemes I suggest that Government should start a Crop Insurance scheme in order to help the cultivators of this country. We have a number of Agricultural Officers all over the country and they could look after the crops of cultivators. They could see what is being done by the cultivator, whether the cultivator takes proper care of his crops, &c. When once the crop has failed, the cultivator is frightened to begin again thinking that the second crop also might be a failure. If there is a crop insurance scheme then he knows that Government will come to his aid in case the crop is a failure, so that he is encouraged to grow more crops than he is doing today. When crops fail, a certain percentage of the loss can be met by the Government. I therefore request that this resolution also be considered by the Board. One part of the country's crops are damaged by drought while another part of the country's crops are damaged by floods. You cannot prevent this damage but when the Government is prepared to pay a subsidy, people will take some interest. Floods and drought come in so suddenly owing to the neglect of Government. Formerly we got droughts or floods in cycles of 4 or 5 years but now they occur so frequently owing to mismanagement of forests in this country. Therefore I propose that this resolution of mine be considered by the Board."

Mr. E. Muttucumaru seconded the resolution subject to an amendment he moved, that a Sub-Committee be appointed as in the case of the earlier resolution.

The mover of the resolution, Gate Mudaliyar Wickremaratne, agreed to the amendment.

Mudaliyar N. M. Abulcassim Maraikar in supporting the resolution said that owing to the vagaries of weather conditions, cultivators found it impossible to do cultivation. Invariably after seasonal rains fail there was a complete failure of crops. If the seasonal rains did not come in abundance, then there was a partial failure. Sometimes at a time when the cultivator does not require rain there is an abundant rainfall and as a result the crops are subjected to floods. He therefore strongly felt that a crop insurance scheme would provide ample measures to benefit the cultivator who would otherwise be financially crippled after the failure of crops. He said he remembered the words of Hon. Mr. Dudley Senanayake when he visited his area that he (the Minister) was contemplating on a crop insurance scheme for the benefit of paddy cultivators. He therefore felt that the Minister would pay attention to bring this scheme into force. He said he was really in sympathy with the cultivators and that a Scheme of that nature would be very useful to cultivators to bring more land under cultivation and also to prevent the cultivators from being financially crippled.

The Director, Rural Development, said that whilst it was generally agreed that crop insurance would be a great encouragement to the producer and that the production of paddy would be increased, particularly on the face of the fast changing weather conditions, if an insurance

scheme was organized, he could foresee a number of very great difficulties in working such an Insurance Scheme. He said that perhaps all members would be aware that there was about 850,000 acres of paddy in this country and taking into account that two seasons are cultivated there are about a million acres of paddy cultivated annually. He had been trying to assess what the unit of ownership of paddy was and in a number of districts the average holding of paddy was less than a quarter acre. He made particular reference to Kurunegala District where about 90 per cent. of the holdings were less than quarter of an acre and that there were only four units which were over 30 acres. Besides this fragmentation of holdings, there was the problem of co-ownership. In such cases the payment of premiums, &c., would be a complicated problem. Apart from those difficulties, the major difficulty he could see was that the peasants did not do any systematic method of cultivation. He stressed the fact that proper registration of land was very essential in such an event because at present only the title is registered. In case of crop insurance, the extent of land, details of ownership, tenancy, the cultivation practices, &c., should be known in greater precision. As much as a Crop Insurance Scheme is difficult, it is realized that is is very desirable. He also envisaged several difficulties in the way of an Insurance Scheme due to the absence of any systematic production of paddy and systematic cultivation among the peasantry. He felt that there was still a great deal to be done in the matter of proper crop assessment, yields, tenure system, &c.

Senator Justin Kotalawala :—" I think Sir, with regard to the observations made by the last speaker, it occurs to me that it is not so difficult in the case of crop insurance as in the case of cattle insurance. Here we have a unit that is not movable while in the case of cattle they can be shifted from place to place ". In the case of crop insurance he felt that it should be made compulsory where paddy lands are concerned. He suggested that every owner of paddy lands should be compelled to come into the Insurance Scheme and the premium could be one rupee or 50 cents an acre, so that if there are million acres there would be Rs. 1,000,000 collected by the Government for the paddy insurance fund. If an owner was claiming a loss on his insurance certificate, it could be checked and ascertained, and the owner could be compensated. He added that judging on broad principles, a Crop Insurance was not so difficult to work as was the case in Cattle Insurance, because here the unit is static. In conclusion he said, " Just as it is compulsory for a motor vehicle to be insured before it is put on the road, it could be made compulsory for every paddy land to be insured. It is a matter of organization and I think if you put this to the same committee both these could be discussed, and if there are others who would like to come to this committee they might also be included".

Mr. W. P. A. Wickremasinghe, M. P.:—" I agree that there should be a Crop Insurance Scheme, but before we think of insurance schemes, I would like to say that this Board for the last two or three years have been urging that Government should introduce legislation for the prevention of fragmentation of land. I find that still no steps have been taken to prevent fragmentation. Then, we have been asking for a paddy Bill. Even in the Governor-General's address at the opening of Parliament it was mentioned that the Paddy Bill should be made law by 1950. This is 1951 and we find that nothing has been done. Before we make any efforts in Crop Insurances we should introduce legislation to stop fragmentation and should get the Paddy Bill brought up before Parliament. If that can be done, I think these Insurance Schemes should take second place".

Mr. A. M. Clement Dias :—" It is not impossible but it will be very difficult to register paddy land owners. Therefore instead of putting the cart before the horse we should co-ordinate these activities and improve the paddy industry. Sir, if the paddy industry is properly handled we can get more than 50 per cent. from paddy lands. We need not go to other places to get

experts ; we have experts in Ceylon. So far nothing has been done properly. There must be proper organization and we should have proper seed obtainable in villages. What happens is that the cultivator has no money and he eats his seed paddy before the next crop. If you have to be giving seed paddy to these cultivators we need not have pureline seed paddy. They can try some high-yielding seed paddy."

Mr. A Perumynar suggested that in case of an Insurance Scheme for paddy there should be certain requirements such as proper methods of cultivation, proper sowing, &c., so that the Insurance Scheme would also be helpful to encourage proper methods of cultivation among cultivators.

Mr. R. B. Thalakada (Assistant Registrar of Co-operative Societies) commenting on the ability to pay the premiums, said that that led to the question of economic holdings. In the Wet Zone there were a number of people holding small bits of land. In the Dry Zone one man holds a number of bits which may be in the same ' yaya '. He therefore emphasized the necessity for the introduction of legislation to prevent fragmentation of holdings. He said that the All-India Committee had also gone into this question and they recommend that the State should undertake this work first.

Mr. Marcus Rockwood expressed his view that for the purpose of insurance it was very essential to have a reliable unit of measurement, say in measures, lahas, &c., so that there should be some basis for assessing the crop or failure of crop. He felt that that was not possible unless there were statistics of yields in various districts of the Island. He emphasized that one could never assess what the maximum and the average yield was without such statistics. He said that another snag was the correct assessment of water required in different districts so that there would be a proper check if a failure is attributed to lack of water.

Senator Justin Kotalawala said that the question of fragmentation did not arise. If a paddy land was owned by ten people each would pay 1/10th of the premium. Whether it was paid by one person or ten people the purpose would be served. As regards the payment of damages, he said that a certain ratio could be worked out based on the yields of each district. In places where the yields are high the damage paid would be higher than in other places. He said that those were simple statistics to obtain and saw no reason why those difficulties could stand on the way of an Insurance Scheme.

Chairman :—" Well Gentlemen, we have had a very good discussion on this resolution and like the previous resolution in the name of Gate Mudaliyar Wickremaratne, this has got to be referred to a Sub-Committee for consideration. I think you will agree that this is a very desirable procedure because this Sub-Committee could consider this in an absolute calm atmosphere. I therefore would put this proposal to the Board for your favourable consideration."

The motion was put to the House and carried.

The Board also agreed that this resolution be placed before the same Sub-Committee and on the suggestion of Mr. W. M. Cumaraswamy a few who were interested in paddy cultivation were also included into the Committee.

Mr. Marcus Rockwood suggested the name of Dr. M. F. Chandraratne, Botanist and Senior Research Officer.

The Chairman said that all officials of the department would be available at any time for the discussion.

The following were appointed in addition to those already in the Sub-Committee set up for the purpose of considering Gate Mudaliyar Wickremaratne's earlier resolution :—

The Deputy Director of Agriculture, Director, Rural Development, Mr. C. A. M. de Silva, Mr. W. P. A. Wickremasinghe, Mr. A. Perumynar, and Mudaliyar Abulcassim Maraikar.

It was also agreed that the Committee should meet in Colombo and that the Deputy Director of Agriculture would be Convener.

The full Sub-Committee consist of the following :—

The Deputy Director of Agriculture (Convener), Director, Rural Development, Mr. C. A. M. de Silva, Mr. W. P. A. Wickremasinghe, Mr. A. Perumynar, Senator Justin Kotalawala, Mr. W. M. Cumaraswamy, Rev. Fr. L. W. Wickremasinghe, Mr. A. M. Clement Dias, The Registrar of Co-operative Societies, The Deputy Director (Animal Husbandry), T. B. Poholiadde Dissawa, Gate Mudaliyar N. Wickremaratne, and Mudaliyar Abulcassim Maraikar.

Item 3 (*c*) on the agenda—Gate Mudaliyar N. Wickremaratne moved the following resolution :—

"IN ORDER TO ENCOURAGE PRODUCTION OF MORE FOOD FROM THE EXISTING PADDY FIELDS AND ALSO IN CERTAIN CASES TO PROTECT PADDY FIELDS FROM DISUSE AS PADDY FIELDS BY SILTING, THAT IMMEDIATE STEPS SHOULD BE TAKEN BY GOVERNMENT TO PRESERVE AND RESTORE PITA ELAS AND WANATHAS BORDERING TEA AND RUBBER LANDS IN THE UP-COUNTRY DISTRICTS IN THE ISLAND."

Gate Mudaliyar N. Wickremaratne :—" Like Australia or America we do not grow any other kind of food except our paddy and it is therefore essential that we should protect the existing paddy fields. The Department of Agriculture and the Ministry of Agriculture have done a great deal in opening up new lands for paddy at great expense. I know millions of rupees have been spent during the last 15 years or more on asweddumization. If that is so Sir, should we allow paddy lands already in existence to be destroyed and converted into high land ? This is what I have seen during the last 45 years. I have been travelling in this part of the country and I see a great danger of blocks of paddy fields being turned into highland. In most places the fertility of the land is getting lost as these Wanathas and Pita Elas have all been silted up and some of them have disappeared completely. Pita Ela is a Sinhalese term for a small canal running between a paddy field and a highland to carry away water without allowing the silt to get into the paddy field. Wanatha is a reservation with jungle a bit away from the paddy field towards the highland in order to prevent soil erosion or to prevent the soil getting washed into the Pita Ela. Unless we take some steps to prevent this silting up, most of our paddy fields bordering the tea lands, rubber lands, &c., will disappear and the fertility of the fields will also disappear. Fields that gave 60 bushels of paddy forty years ago produce only 30 bushels now. Most of the silting has been in Kandy, Nuwara Eliya and Gampola areas and unless this is prevented, it will be a danger to these fields. This is the time we should think of soil erosion as we have an expert with us and I think before he takes up any question he should take up the problem of Elas and small streams getting silted. Every villager will give the necessary information about these Pita Elas and Wanathas and I think if a beginning is made

with the G. A. collecting reports from the Headman, then it will be easy for the Soil Conservation Officer and the Forest Department to take necessary steps to preserve these. I remember some years back, in 1911, when I was A. I., Kegalla, there was a cry for increasing the acreage under rubber and land in that area were acquired and planted up with rubber. People complained about the silting and the damage caused to the paddy lands and I myself saw the damage. Up to that time these Pita Elas were preserved and it was after that time these Pita Elas got silted up. Therefore I suggest that some steps be taken through the G. A. to take an estimate of the damage done to these Pita Elas and Wanathas. I must say again that the Forest Department has been responsible for this neglect. Once the Kandy District Agricultural Committee discussed at length the question of repairing these small tanks, Pathahas, but found that as soon as these Pita Elas were cleared, they were again silted up. To make use of these Pathahas we must preserve the Wanathas. There are people who say that we have no experience, we cannot do that and that we have to get opinion from outside. I think those gentlemen, if they have a little more experience, will agree that we can adapt ourselves to suit our own requirements. When the Co-operative Ordinance was to be passed, out of the nineteen G. A.'s eighteen wrote to say that Co-operative Societies could not be started in Ceylon except the G. A., Uva, who supported the idea. But today these gentlemen speak on behalf of Co-operative Societies. Therefore Sir, we have to see that we protect our existing paddy fields which are the only source of food. I will therefore end with these words and hope the Central Province members would take up this question."

Mr. W. P. A. Wickremasinghe said he would rise to a point of order before the resolution was seconded because the points put forward in that resolution were all covered by the existing Irrigation Ordinance. He emphasized that there was rigid legislation for the prosecution of people who allowed their fields to get silted, and for the payment of compensation.

Poholiadde Dissawa in seconding the resolution said that as his colleague had pointed out it was the duty of the owner of the paddy field to keep the Pita Ela clear. It was very seldom that the owner of the Pita Ela and the owner of the adjoining estate was the same. When the estate silt came down to the Pita Ela it did not lie in the hands of the poor paddy owner to remove the silt but it was for the owner of the adjoining estate to prevent the Pita Ela from silting.

Senator Justine Kotalawala referring to Mr. Wickremasinghe's point of order said that a point of order did not arise on that occasion. Even though there was an ordinance and if the ordinance was not in operation, Mudaliyar Wickremaratne had every right to bring up a proposal.

Mr. W. P. A. Wickremasinghe said that it was only a duplication of work.

Mr. Singleton Salmon said that he knew of several instances of complaints being made to the G. A. on paddy fields getting silted up and the owners of fields had been compensated.

Senator Wijesinghe said that he was faced with the same difficulty when people had sent petitions to the G. A. about paddy fields adjoining his estate getting silted and he had to pay compensation.

Poholiadde Dissawa said that he merely supported Gate Mudaliyar Wickremaratne's resolution so that with the help of G. AA. action should be taken to prevent the Pita Elas from silting. The other point he would like to bring to the notice of the Board was that in the Dry Zone where there was no silting by the estates round about, action should be taken to divert the surplus water or the spill water from the tanks. During a heavy rainy season when the tank begins to spill, the surplus water runs through somebody's paddy fields. This had been brought

to the notice of Government and they say that it is difficult to avoid such overflowing. In conclusion he requested that the point he raised should also be included in Mudaliyar Wickremaratne's resolution.

At this stage the Chairman said that it was a matter of doubt as to whether that motion was *ultra vires* or not and he would therefore like to have a vote on it whether it should be discussed.

The Board voted for the deferment of this motior till the Director of Irrigation was present for discussion.

Item 4 of the agenda—Mr. R. T. Chelliah moved—

"THAT THIS BOARD SHALL DISCUSS WHAT STEPS SHOULD BE TAKEN TO MAINTAIN THE RESPECT AND HIGH STANDARD OF ALL CEYLON PRODUCTS SUCH AS TEA, RUBBER, COCOA, COPRA, DESICCATED COCONUT, FIBRE, OILS, CINNAMON, &c., FOR EXPORT AND LOCAL USE : AND WHAT STEPS SHOULD BE TAKEN ON TRADERS AND OTHERS WHO ADULTERATE THESE CEYLON PRODUCTS."

Mr. R. T. Chelliah commented as follows on his motion :—" I have brought this subject for discussion considering everyone of you as great patriots of Free Lanka, and arrive at a reasonable and workable conclusion to maintain the reputation of our products and the country in general.

To have freedom is not so easy as maintaining it. To maintain political freedom is not enough but to maintain the economic freedom of our country is a great thing. For this we have to protect as much as possible the standard of our industries, trade, and commerce, so that the world market without any doubt or fear would pay good prices for our produce because of their high quality.

It is very wrong to think that such protection is only in the hands of the Hon. Ministers. It is in the hands of every citizen of our country and especially in the hands of the producers and the manufacturers and merchants. It is an admitted fact that many of our producers are doing their best to turn out high quality articles, under the supervision of qualified and experienced staff and our products have earned a world-wide reputation, but this can be easily spoilt in no time by a handful of badly managed estates and establishments.

There are certain estates which are concerned in producing large quantities and not quality products. They know very well that if they spoil the quality it would not pay in the long run. But they are badly and easily tempted by the very high prices they get at the present market which make them only think " Make hay whilst the sun shines". This makes a few rich overnight, but brands the Island with a bad name for low quality.

There are certain people who own estates but find it difficult to manage them themselves. They lease out their valuable estates to the highest bidder. One who has taken such estates on lease only considers what one can make out of them before the market falls down. He goes on skinning out the life of the producing plants. The life of such estates are ruined, the owner is ruined, the tenant is also ruined, and finally all of them jointly ruin the high standard of Ceylon produce.

The machinery in certain estates is badly neglected. The parts are worn off and wasted. The wasted parts are not promptly replaced or attended. Such neglected machinery is unable to turn out good results, so poor quality goods are produced. This quality is very much below

the standard quality. Owners of such factories try to buy high quality products from good factories and mix good quality articles with their bad products, pack these in beautiful cases and export these to foreign markets. This type of gambling brings great disgrace to our country.

Certain people mix all sorts of dust in tea just to increase the quantity and weight and badly spoil the quality. As a result, I am told, certain people sometime ago have inserted lead rods into cinnamon just to add more weight, with the idea of making more money. There are other people who know the art of putting in water in the copra when it is in the expeller and the chekku when the machine is in action. To the naked eye it makes no difference. Similarly other dishonest methods are adopted by a handful of producers and merchants with selfish motives in order to make money. I can give you some more examples but I do not wish to take much of your time. I want you to help the Government in suggesting ways and means of punishing the culprits and to propose what steps should be taken to maintain the high quality and standard of the Ceylon products I have mentioned in my resolution."

Mr. A. M. Clement Dias seconded the motion.

At this stage the Chairman said that the Director of Industries was invited to participate in that discussion but unfortunately he was unable to attend owing to illness. The following letter from the Director of Industries was read out to the Board by the Secretary.

" Chairman,

Central Board of Agriculture

and Director of Agriculture.

CENTRAL BOARD OF AGRICULTURE

Reference your letter No. AI44/50 of 13.3.51 which was received in my office this morning, I regret that as already advised by telegram, I am unable to attend the meeting of the Central Board of Agriculture fixed for the afternoon of Monday, 19.3.51. My assistant is also on sick leave at present.

2. This department has given consideration to the enforcement of quality standards for our major export products. A National Mark is used in other countries to ensure the quality of agricultural products for home consumption and export purposes. I find that legislation in most countries has been introduced after long years of study of the commodities which need standardization and should carry a guarantee of quality.

As regards exports, some of the more important items such as Tea and Rubber, do not lend themselves to quality control by the affixing of a National Mark. But the question of adulteration of Tea has received the attention of the Ceylon Tea Propaganda Board, and regulations have been prepared in draft form under the Local Food and Drugs Act to ensure that only wholesome tea is packetted and sold locally.

3. A meeting was convened by the Director of Industries on 1.3.50 at which two special committees were set up for the purpose of formulating standards for Kapok and Citronella oil and making recommendations on the machinery that should be set up to provide facilities for shippers to obtain certificates of quality on a voluntary basis. I was appointed Chairman of the 2nd Committee and considerable progress has been made on the studies in Citronella oil. Much available information has been obtained from Indonesia (a large supplier of this product) in regard to the procedure followed for the issue of quality certificates. Technical specifications

have been prepared and we are now working on the practical aspects of conducting tests, &c., in consultation with the Government Analyst. I have reason to believe that if a reasonably inexpensive service can be devised, which is not prone to delays in the drawing of samples, laboratory tests and issue of certificates, the Trade will support the scheme. Judicious propaganda abroad in consuming markets, of the existence of quality standards, will make the local shippers increasingly conscious of the benefits of the scheme and stimulate voluntary adherence to it.

4. The Ceylon Coconut Board is now giving attention to the desirability of formulating standards for coconut products—particularly copra. Documentation is available in this office in regard to the practices followed in the Philippines where a fairly strict control is exercised over the quality of copra exported. This department will remain in close touch with the Coconut Board in its deliberations on this subject.

5. In my view several of our export products can benefit by the introduction of specifications which carry a meaning in world markets. But I do not advocate a compulsory enforcement of standards at this stage.

In this connection it is interesting to note the evolution of the British Standards Institute and the South African Bureau of Standards. They had their beignnings in Committees of the type here mentioned which were eventually merged, after building on experience, to institutions formed by statute and equipped with technical staff and laboratory facilities to undertake standardization over a wide field of industrial and agricultural products.

6. If there is any further information that you would require on the subject, I shall be glad to furnish it.

Sgd. L. S. B. Perera,
Acting Director of Industries.

Department of Commerce,
Colombo, March 17, 1951."

The Assistant Commissioner, Marketing Department. said that in regard to internal trade there is already an Ordinance on the statute with regard to standards—The Agricultural Products Grading and Marking Ordinance, No. 8 of 1940. His department is taking action to have the Ordinance implemented at an early date. Requisite technical personnel are being trained, and standards are being determined.

Mr. E. Muttucumaru in endorsing the views of the Assistant Marketing Commissioner said that the difficulties one had to face was that while the producer was anxious to maintain the quality of his products, the middleman was interfering and tampering with the quality of the product.

Mr. W. P. A. Wickremasinghe said that certain commodities like Citronella oil were rejected unless they were diluted with kerosene. He had himself experienced this when 300 bottles of Citronella shipped to New York through Aitken Spence & Co. were returned to him. The same Citronella was diluted with 30 bottles of kerosene and were purchased and accepted as of very good quality. The test that was carried for ascertaining purity was the Seimen's test, and almost every producer got through this test by adding kerosene.

The Chairman said that he feels that the only reliable test for Citronella oil was a test for its Geraniol content. There was no real satisfactory test other than its Geraniol content.

The Chairman inquired that since the Department of Commerce had said that the matter was receiving careful consideration and in view of the fact that the Marketing Department was interested themselves in maintaining the quality of products, whether it was within the functions of the Board to consider that matter. Each one of those products should receive the careful attention of the producers and the trade and the people who were most competent to deal with it were therefore the Ministry of Commerce, but the producers would have their say in determining the quality. He inquired whether it was the wish of the Board that that resolution should be passed.

Director, Rural Development, suggested that the observations of the Board be communicated to the Director of Commerce.

At this stage Mr. Marcus Rockwood requested that some of the F. A. O. literature be made available to the Board.

Professor Hardy, Leader of the F. A. O. delegation replied that he would contact the F. A. O. authorities and request that literature which was applicable to conditions in Ceylon be made available to the Board.

Major E. C. de Fonseka proposed a very hearty vote of thanks to the Director of Agriculture and Chairman of the Board for the very excellent lunch that was provided on the day of the meeting.

Mr. C. A. M. de Silva (Vice Chairman) :—" This is the first occasion that a Ceylonese has been appointed Director of Agriculture in this Island. When we were given the assurance that Dr. Joachim would be appointed to the post, we had our doubts as to the Government's promise. But this time to our surprise and to our pleasure we have learnt that Dr. Joachim has been confirmed in the post of Director. On your behalf let me wish him all success and let me give a word of warning to his staff to give him all the co-operation in the discharge of his duties. If he creates a successful post, that means that every other individual in his department will have a chance of succeeding him. We give him our heartiest congratulations and best wishes."

Chairman :—" Mr. Silva and Gentlemen, I thank you very much for the kind sentiments expressed in regard to my appointment to the post of Director. I am deeply conscious of the honour that has been conferred on me and I shall do my duty to the utmost to make a success of my post.

The meeting terminated at 4.30 p.m.

R. L. ARNOLDA,
Secretary, Central Board of Agriculture.

Peradeniya, March 28, 1951.

MINUTES OF THE MEETING OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON, HELD AT 10.30 A.M. ON WEDNESDAY, FEBRUARY 14, 1951, AT THE OFFICES OF THE PLANTERS' ASSOCIATION OF CEYLON, 113, STEUART PLACE, COLOMBO

Present.—Mr. R. C. Scott, C.B.E. (Chairman), The Acting Director of Agriculture (Dr. A. W. R. Joachim, M.B.E.), The Acting Secretary to the Treasury (Mr. A. G. Ranasinha, C.M.G., C.B.E., C.C.S.), Messrs. V. G. W. Ratnayake, M.B.E., M.P., J. C. Kelly, H. de T. Wilkinson Kay, W. H. Attfield, and J. Lamb (Director and Secretary).

Letters from the Chairman, Planters' Association of Ceylon (Mr. R. C. L. Notley), and the Chairman, Agency Section, Planters' Association of Ceylon (Mr. R. S. Davies), and a telegram from Mr. H. S. Hurst, were received regretting their inability to attend.

1. NOTICE CONVENING THE MEETING WAS READ.

2. The minutes of the meeting held on December 20, 1950, were confirmed subject to the inclusion of the following omission. On page 4 under Estimates (St. Coombs Estate) Capital Account, Vote 73 Buildings—Estate School.

> " It was agreed that the entire building for the school, cost of which is to be shared with Mattakelle should be on St. Coombs Estate ".

3. MEMBERSHIP OF THE BOARD

The Chairman reported that Mr. R. S. Davies of Messrs. Boustead Bros., Ltd., became an ex-officio member of the Board with effect from January 18, 1951, on his having been elected Chairman of the Agency Section of the Planters' Association of Ceylon, vice Mr. G. K. Newton resigned.

He referred to the great interest Mr. Newton had always shown in the affairs of the Board and the valuable services he had rendered as a member. On behalf of the entire Board he proposed a special vote of thanks to Mr. Newton. He then extended a cordial welcome to Mr. R. S. Davies who took Mr. Newton's place on the Board.

4. LOW-COUNTRY SUB-STATION

The Chairman reported that Mr. T. E. Walter, Scientific Officer, had moved to Nivitigalakele as from February 1, 1951.

5. ANY OTHER BUSINESS

(*i*) *Small Holdings.*—The Chairman reported that a meeting at which Mr. V. G. W. Ratnayake, Dr. A. W. R. Joachim, Mr. U. B. Unamboowe, and the three Small Holdings Officers would be present, had been convened and would take place at St. Coombs on Thursday, February 20, to consider the Small Holdings Advisory Service.

(*ii*) *Visit of the Minister of Agriculture to St. Coombs.*—The Director reported that Mr. Dudley Senanayake, the Minister of Agriculture, was paying an official visit to the Tea Research Institute at 10 a.m. on Thursday, March 29. He considered it would be advantageous to hold the next meeting of the Board at St. Coombs at 2.30 p.m. on Wednesday, March 28. This would permit members of the Board to be present at the time of the Minister's visit.

(*iii*) *Handbill on Blister Blight.*—Mr. V. G. W. Ratnayake tabled an illustration on blister blight which he had obtained while he was in Indonesia recently. He considered it a very useful poster to be issued for exhibition at Post Offices, Railway Stations, &c.

The Director agreed to arrange for the printing and distribution of these posters as suggested.

Tea Research Institute,
Talawakelle, April 10, 1951.

J. Lamb,
Secretary.

Rubber Research Scheme (Ceylon)

MINUTES OF THE 106TH MEETING OF THE RUBBER RESEARCH BOARD HELD AT THE PLANTERS' ASSOCIATION HEADQUARTERS, COLOMBO, AT 2.30 P.M. ON TUESDAY, MARCH 20, 1951.

Present.—Mr. F. H. Griffith, M. P. (in the Chair); Major Montague Jayewickreme, M.P.; Dr. A. W. R. Joachim (Director of Agriculture); Mr. R. J. Hartley; Mr. F. A. Obeyesekera; Mr. J. L. D. Peiris; Mr. R. H. Wickremasingbe (Controller of Establishments); Dr. H. E. Young (Acting Director, Rubber Research Scheme).

1. MINUTES

Draft minutes of the meeting held on February 7, 1951, which had been circulated to members, were confirmed and signed by the Chairman.

2. BOARD

(*a*) *Mr. Francis Amarasuriya* had left Ceylon on March 6, and would be away until the end of June. The L. C. P. A. had not yet nominated a member to act for Mr. Amarasuriya.

(*b*) *Mr. R. H. Wickremesinghe, C.C.S.*, Controller of Establishments, had been deputed to represent the Minister of Finance in place of Mr. W. J. A. Van Langenberg with effect from March 14, 1951.

(*c*) *Mr. F. H. Griffith.*—The Chairman reported that he would be away from Ceylon from April 6 until August 6, 1951. It was agreed that the Planters' Association of Ceylon be asked to nominate a member to act as its representative on the Board during the period of Mr. Griffith's absence from Ceylon, and that Dr. H. E. Young, Acting Director, should officiate as Chairman of the Board during this period.

3. REPORTS AND ACCOUNTS

(*a*) *Visiting Agent's Report* was adopted and it was agreed that Mr. J. D. Farquharson should continue to function as the Scheme's Visiting Agent.

(*b*) *Visiting Engineer's Report* was adopted.

(*c*) *Statement of Receipts and Payments for the 4th Quarter, 1950,* was approved.

(*d*) *Estate Accounts from September to December, 1950,* were tabled.

4. EXPERIMENTAL COMMITTEE

The Experimental Committee was reconstituted to consist of only members of the Board.

5. STAFF

(*a*) *Director.*—It was reported that Dr. E. Phillis had left Ceylon, having handed over charge of the Scheme's affairs to Dr. H. E. Young.

(*b*) *Chemist and Agronomist.*—It was reported that Mr. Constable, Agronomist, and Dr. Risdon, Chemist, were due to arrive in Ceylon on April 16 and 25, respectively.

(*c*) *Estate Superintendent.*—It was reported that Mr. G. W. D. Barnet had assumed duties as Estate Superintendent on February 7.

(*d*) *Research Assistants.*—The principle of sending suitable Research Assistants abroad for training after the completion of their period of probation, was accepted.

(*e*) *Bungalows and Club House.*—Approval was given for the construction of two bungalows for Research Assistants and a Club House at Dartonfield.

6. LEASE OF NIVITIGALAKELE EXPERIMENT STATION TO THE TEA RESEARCH INSTITUTE

In view of certain facts recently made available to the Board, it was agreed that Nivitigalakele Experiment Station should not be leased to the Tea Research Institute. The Acting Director was asked to withdraw the application for transfer.

7. CREPE BLEACHING

It was reported that the R. R. I. Malaya had agreed to allow the process patented by them for the bleaching of crepe rubber by the use of R. P. A. 3 emulsion to be used by producers in Ceylon subject to approval by the Scheme. Producers had been informed through the P. A. of Ceylon and certain importers were making arrangements to import the necessary chemicals.

Dartonfield,
Agalawatta, April 19, 1951.

C. D. DE FONSEKA,
Secretary-Accountant.

Rubber Research Scheme (Ceylon)

MINUTES OF THE ONE HUNDRED AND SEVENTH MEETING OF THE RUBBER RESEARCH BOARD, HELD AT THE CEYLON CHAMBER OF COMMERCE, COLOMBO, AT 3.15 P.M. ON TUESDAY, MAY 29th, 1951

Present.—Dr. H. E. Young, Acting Director (in the Chair) ; Mr. F. A. Obeyesekera ; Mr. R. J. Hartley ; Senator C. Wijesinghe ; Mr. R. H. Wickremasinghe (Controller of Establishments).

Apologies for non-attendance were received from Mr. J. L. D. Peiris, Dr. A. W. R. Joachim, Major Montague Jayawickreme, Mr. D. E. Hettiarachchi, and Mr. W. A. Paterson.

Mr. W. I. Peiris, Smallholdings Propaganda Officer, was present by invitation, when discussing the items on the Agenda relating to Smallholdings Department.

1. MINUTES

Confirmation.—Draft minutes of the meeting held on March 20, 1951, which had been circulated to members, were signed by the Chairman, after inclusion of an amendment.

Latex Centres.—It was reported that a latex centre had been opened by Smallholders at Dapiligoda near Agalawatta and arrangements have been made to buy the latex from this centre and transport to Dartonfield Factory for manufacturing purposes.

Budded Stumps.—It was agreed to sell budded stumps to Smallholders at 25 cents for those who own under 5 acres, and 35 cents for those of 5 to 100 acres.

2. BOARD

The Chairman reported that :

(*a*) Mr. D. E. Hettiarachi, J. P., U. M., has been nominated by the L. C. P. A. to act during the absence of Mr. Francis Amarasuriya from Ceylon.

(*b*) Mr. W. A. Paterson has been nominated to represent the Planters' Association of Ceylon during the absence of Mr. F. H. Griffith while on furlough.

(*c*) A letter from Major Montague Jayawickreme was tabled stating that he will be away from the Island till end of September, 1951, and asking leave from the Board. Leave was approved and it was agreed that the Minister of Agriculture and Lands be asked to nominate a member to act during Major Jayewickreme's absence from Ceylon.

3. REPORTS AND ACCOUNTS

(*a*) *Investment.*—Reported that a sum of Rs. 500,000 had been placed on Fixed Deposit for 6 months at 1/2 per cent. interest.

(*b*) *Annual Report for 1950.*—This was considered and approved.

(*c*) *Revote of balances of 1950 capital votes.*—Balances of 1950 capital votes amounting to Rs. 31,850/62 were revoted.

(*d*) *Recast Estimates for 1951.*—These were approved as there were no changes in the total Revenue and Capital Expenditure and also in the Income for 1951.

4. EXPERIMENTAL COMMITTEE

Recommendations made at meeting held on May 15, 1951 :

(*a*) *Disposal of Rejected articles*—to dispose these articles after a notification to the public by way of advertisements of some kind.

(*b*) *Research Programme.*—Botany Department, Chemical Department, and Agronomy Department. These were considered and approved.

(*c*) Sale of Cart and Bull.

(*d*) Promotion of 1 junior staff to grade of Clerk.

5. STAFF

(*a*) Reported that Dr. E. J. Risdon, Chemist, and Mr. D. H. Constable, Agronomist, had arrived in Ceylon and assumed duties on April 28 and April 16, 1951, respectively.

(*b*) *Junior Staff.*—Changes in junior staff since the last meeting were reported.

6. COCOA

A letter from the P. A., Ceylon, suggesting that arrangements be made for cocoa research to be organized as a branch of the R. R. S., was tabled. The Acting Director was requested to inform the P. A., Ceylon, that the Research Scheme is exploring the possibilities of making arrangements for cocoa research, but in the meantime would the P. A. find out what finance, could be made available for such a scheme, as it would, if undertaken, necessitate the appointment of a new officer so that full time attention could be given to the subject.

H. E. Young,
Acting Chairman.

Dartonfield,
Agalawatta, June 16, 1951.

SUMMARY OF OUTBREAKS OF SCHEDULED ANIMAL DISEASES WITHIN THE DOMINION OF CEYLON—MONTH ENDED FEBRUARY 28, 1951

Province	Disease	Fresh Cases during the month	Total number from the beginning of this calendar year to February 28, 1951				Balance Ill at end of month
			Diseased	Deaths	Shot	Recoveries	
Western Province ..	—	—	—	—	—	—	—
Colombo Municipality	Anthrax	2	3	3	—	—	—
	Piroplasmosis	1	3	3	—	—	—
	Haemorrhagic Septicaemia	—	1	1	—	—	—
	Rabies	4	13	13	—	—	—
Quarantine Station	Anthrax (in sheep and goats)	8	17	17	—	—	—
	Pleuro-pneumonia	5	5	5	—	—	—
	Piroplasmosis	2	2	2	—	—	—
Northern Province	Rabies	1	1	—	1	—	—
	Pleuro-pneumonia (goats)	—	18	18	—	—	—
	Foot-and-mouth	4	4	—	1	—	3
North-Central Province ..	Foot-and-mouth	344	428	—	—	88	340
North-Western Province	Black Quarter	—	3	3	—	—	—
	Foot-and-mouth	—	39	2	—	37	—
Central Province	Mange (cattle)	15	42	2	—	25	15
	Foot-and-mouth	121	121	—	—	—	121
	Piroplasmosis	—	1	—	—	1	—
Province of Sabaragamuwa ..	Rabies	—	1	—	1	—	—
Province of Uva ..	Rabies	1	1	—	1	—	—
Eastern Province ..	—	—	—	—	—	—	—
Southern Province ..	—	—	—	—	—	—	—

Peradeniya, CEYLON.
March 29, 1951.

T. M. Z. MAHAMOOTH,
Deputy Director (Animal Husbandry)
and Government Veterinary Surgeon.

SUMMARY OF OUTBREAKS OF SCHEDULED ANIMAL DISEASES WITHIN THE DOMINION OF CEYLON—MONTH ENDED MARCH 31, 1951

Province	Disease	Fresh Cases during the month	Total number from the beginning of this calendar year to March 31, 1951				Balance ill at end of month
			Diseased	Deaths	Shot	Recoveries	
Western Province	Foot-and-mouth	25	25	—	—	12	13
	Rabies	4	4	4	—	—	—
Colombo Municipality	Foot-and-mouth	17	17	—	—	17	—
	Anthrax	—	3	3	—	—	—
	Tuberculosis	1	1	1	—	—	—
	Piroplasmosis	—	3	3	—	—	—
	Rabies	4	17	17	—	—	—
	Haemorrhagic Septicaemia	—	1	1	—	—	—
Quarantine Station	Anthrax (in sheep and goats)	3	20	20	—	—	—
	Pleuro-pneumonia	19	24	24	—	—	—
	Piroplasmosis	1	3	3	—	—	—
Northern Province	Rabies	1	2	—	2	—	—
	Pleuro-pneumonia (goats)	20	38	38	—	—	—
	Foot-and-mouth	7	11	—	1	10	—
North-Central Province	Foot-and-mouth	—	428	—	—	428	—
North-Western Province	Rabies	1	1	—	1	—	—
	Black Quarter	—	3	3	—	—	—
	Foot-and-mouth	10	49	2	—	42	5
Central Province	Mange (cattle)	40	82	3	—	60	19
	Foot-and-mouth	216	337	1	—	120	216
	Piroplasmosis	—	1	—	—	1	—
Province of Sabaragamuwa ..	Rabies	1	2	—	2	—	—
Province of Uva	Black Quarter	11	11	11	—	—	—
	Rabies	2	3	1	2	—	—
Eastern Province ..	Rabies	1	1	—	1	—	—
Southern Province ..	Anaplasmosis	1	1	—	—	1	—

G. V. P. GOONEWARDHENA,
for Deputy Director (Animal Husbandry)
and Government Veterinary Surgeon.

Peradeniya, CEYLON,
May 7, 1951.

SUMMARY OF OUTBREAKS OF SCHEDULED ANIMAL DISEASES WITHIN THE DOMINION OF CEYLON—MONTH ENDED APRIL 30, 1951

Province	Disease	Fresh cases during the month	Total number from the beginning of this calendar year to April 30, 1951				Balance ill at end of month
			Diseased	Deaths	Shot	Recoveries	
Western Province	Foot-and-mouth	—	25	—	—	25	—
	Rabies	—	4	4	—	—	—
Colombo Municipality	Foot-and-mouth	17	34	—	—	34	—
	Anthrax	3	6	6	—	—	—
	Tuberculosis	2	3	3	—	—	—
	Piroplasmosis	1	4	4	—	—	—
	Rabies	2	19	19	—	—	—
	Haemorrhagic septicaemia	—	1	1	—	—	—
Quarantine Station	Anthrax (in sheep and goats)	—	20	20	—	—	—
	Pluero-pneumonia (goats)	13	37	37	—	—	—
	Piroplasmosis	—	3	3	—	—	—
Northern Province	Rabies	—	2	—	2	—	—
	Pleuro-Pneumonia (goats)	—	38	38	—	—	—
	Foot-and-mouth	—	11	—	1	10	—
	Anthrax	6	6	6	—	—	—
North-Central Province	Foot-and-mouth	—	428	—	—	428	—
North-Western Province	Rabies	—	1	—	1	—	—
	Blackquarter	—	3	3	—	—	—
	Foot-and-mouth	—	49	2	—	47	—
Central Province	Mange (cattle)	18	100	5	—	77	18
	Foot-and-mouth	11	348	1	—	336	11
	Piroplasmosis	—	1	—	—	1	—
Province of Sabaragamuwa	Rabies	—	2	—	2	—	—
Province of Uva	Black quarter	—	11	11	—	—	—
	Rabies	1	4	1	3	—	—
Eastern Province ..	Rabies ..	1	2	1	1	—	—
Southern Province ..	Anaplasmosis ..	—	1	—	—	1	—

T. M. Z. MAHAMOOTH,
Deputy Director (Animal Husbandry),
and Government Veterinary Surgeon.

Peradeniya, CEYLON.
June 1, 1951.

SUMMARY OF OUTBREAKS OF SCHEDULED ANIMAL DISEASES WITHIN THE DOMINION OF CEYLON—MONTH ENDED MAY 31, 1951

Province	Disease	Fresh cases during the month	Total number from the beginning of this calendar year to May 31, 1951				Balance ill at end of month
			Diseased	Deaths	Shot	Recoveries	
Western Province	Foot-and-mouth	—	25	—	—	25	—
	Rabies	1	5	5	—	—	—
Colombo Municipality	Foot-and-mouth	—	34	—	—	34	—
	Anthrax	—	6	6	—	—	—
	Tuberculosis	—	3	3	—	—	—
	Piroplasmosis	—	4	4	—	—	—
	Rabies	2	21	21	—	—	—
	Haemorrhagic Septicaemia	—	1	1	—	—	—
Quarantine Station	Anthrax (in sheep and goats)	—	20	20	—	—	—
	Pleuro-Pneumonia (goats)	11	48	48	—	—	—
	Piroplasmosis	—	3	3	—	—	—
Northern Province	Rabies	2	4	—	4	—	—
	Pleuro-Pneumonia (goats)	—	38	38	—	—	—
	Foot-and-mouth	—	11	—	1	10	—
	Anthrax	—	6	6	—	—	—
North-Central Province	Foot-and-mouth	290	718	—	—	428	290
North-Western Province	Rabies	1	2	—	2	—	—
	Black Quarter	—	3	3	—	—	—
	Foot-and-mouth	—	49	2	—	47	—
Central Province	Mange (cattle)	15	115	8	—	92	15
	Foot-and-mouth	—	348	1	—	347	—
	Piroplasmosis	—	1	—	—	1	—
	Black Quarter	14	14	14	—	—	—
Province of Sabaragamuwa	Rabies	1	3	—	3	—	—
Province of Uva	Black Quarter	—	11	11	—	—	—
	Rabies	1	5	2	3	—	—
Eastern Province ..	Rabies ..	2	4	1	3	—	—
Southern Province ..	Anaplasmosis ..	—	1	—	—	1	—

T. M. Z. MAHAMOOTH,
Deputy Director (Animal Husbandry)
and Government Veterinary Surgeon.

Peradeniya, CEYLON.
June 22, 1951.

5—J. N. B 9070 (7/51.)

METEOROLOGICAL REPORT, MARCH, 1951

STATION	TEMPERATURE				HUMIDITY		Amount of Cloud	RAINFALL		
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)		Amount	No. of Rainy Days	Offset
	°	°	°	°	%	%		in.		in.
Agalawatta	—	—	—	—	—	—	—	—	—	—
Anuradhapura	91·0	—0·2	72·6	+1·0	66	93	2·7	2·34	8	— 1·81
Badulla	82·5	+0·1	63·9	—0·3	72	97	3·6	4·28	12	— 0·77
Batticaloa	85·6	+0·3	75·3	+0·3	75	93	4·2	5·13	8	+ 1·66
Colombo	87·6	—0·4	73·7	—0·3	73	93	3·6	6·21	16	+ 1·55
Diyatalawa	77·4	+0·1	58·2	+0·1	72	91	4·4	2·76	16	— 2·13
Galle	86·9	+0·5	74·0	—1·1	70	81	4·3	8·53	11	+ 3·22
Hakgala	—	—	—	—	—	—	—	—	—	—
Hambantota	86·6	—0·3	74·0	—0·2	74	93	4·4	1·50	6	— 1·89
Jaffna	89·1	+0·5	76·3	+0·5	68	88	3·0	2·26	3	+ 0·68
Kandy	88·8	—0·1	68·3	—0·3	65	92	4·0	3·55	10	— 2·29
Kurunegala	90·9	—2·0	71·7	—0·4	67	93	3·4	6·51	12	+ 0·23
Mannar	88·2	—1·2	75·7	+0·5	74	91	3·0	2·81	5	+ 0·97
Nuwara Eliya	70·1	—0·7	47·5	+1·3	74	90	3·9	2·75	12	— 1·34
Puttalam	90·0	+0·1	73·2	+0·3	70	90	3·6	3·80	7	+ 0·72
Ratmalana	88·3	—	72·9	—	72	93	3·8	4·16	13	— 2·32
Ratnapura	91·9	—0·1	71·6	—0·9	72	93	5·4	9·88	22	— 0·50
Talawakele	77·6	—0·3	55·9	+0·6	66	76	3·6	4·26	14	— 0·36
Trincomalee	85·4	0	76·5	+0·1	76	86	3·7	2·02	5	— 0·28

WEATHER SUMMARY, MARCH, 1951

The rainfall in March did not deviate much from average. But comparatively large excesses occurred in places on the south-western slopes of the hills and the neighbouring mid-country, in Chilaw-Narammala area and in the neighbourhood of Galle and Kegalla, while comparatively large deficits were found in the Southern Province and in a small area round about Kandy. The outstanding excesses were 12·21 inches at Berna Estate, 10·85 inches at Digalla Estate, 9·66 inches at Giriulla, and 9·00 inches at Labugama, and the outstanding deficits 6·74 inches at Hambegamuwa, 6·53 inches at Kirama, 5·83 inches at Maliduwa, and 5·74 inches at Mawarella Estate.

The rainfall was heaviest on the south-western slopes of the hills and the adjacent mid-country, while locally heavy rain was also reported from places in the Haputale hills and from the southern parts of Kurunegala District. The monthly totals in those regions exceeded 10 inches, the highest being 22·76 inches at Digalla Estate, 19·86 inches at Labugama, 19·25 inches at Narammala, and 18·98 inches at Kalatuwawa. Least rain (monthly totals below 2 inches) was experienced to the north of Mankulam, in the eastern parts of North-Central Province, in the central parts of Eastern Province, and along the south-east coast.

The only daily fall over 5 inches recorded in March was 5·21 inches at Chilaw on the 30th. Fairly heavy rain was experienced in the Chilaw-Narammala area on this day, the daily falls at a number of stations exceeding 3 inches.

A hailstorm was reported from Delwita Estate, Kurunegala, on the 11th.

The month started with dry weather. A little rain was experienced on the north-east side on the 4th and 5th. Local afternoon or evening thundershowers which set in thereafter were fairly widespread from the 6th to the 13th and again from the 25th to the end of the month. They were confined to the south-west quarter or the central hills on the 16th and from the 18th to the 22nd.

Temperatures were about normal by day and a little above normal by night. The highest recorded temperature in the shade was 96·0° at Anuradhapura on the 30th, while the lowest temperature for a low-country station was 57·7° at Kurunegala on the 2nd. The lowest temperature for the whole Island was 35·3° at Nuwara Eliya, also on the 2nd. The mean humidity varied from 65 to 75 per cent. by day, and from 85 to 95 per cent. by night. The cloud amounts have not deviated much from average. The wind strength was slightly above normal, the direction being variable.

D. T. E. DASSANAYAKE,
Director.

METEOROLOGICAL REPORT, APRIL, 1951

STATION	TEMPERATURE				HUMIDITY		Amount of Cloud	RAINFALL		
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)		Amount	No. of Rainy Days	Offset
	°	°	°	°	%	%		in.		in.
Agalawatta	—	—	—	—	—	—	—	—	—	—
Anuradhapura	91·7	+0·1	75·0	+0·5	69	93	6·0	7·16	12	+ 0·73
Badulla	83·5	—0·6	66·3	+0·1	73	95	5·6	11·08	19	+ 4·08
Batticaloa	87·7	—0·1	76·9	+0·2	74	93	6·4	2·82	6	+ 0·52
Colombo	87·7	—0·2	75·7	—0·2	76	93	6·8	6·48	17	— 2·59
Diyatalawa	77·3	—0·4	60·7	+0·2	76	94	6·2	8·22	16	+ 1·68
Galle	85·5	—0·6	75·5	—1·2	75	86	6·1	13·79	20	+ 5·08
Hakgala	—	—	—	—	—	—	—	—	—	—
Hambantota	86·6	—1·1	76·0	—0·3	80	91	6·7	4·86	16	+ 1·00
Jaffna	89·0	—0·5	80·3	+0·1	76	85	5·4	4·55	13	+ 2·32
Kandy	87·9	—0·4	70·1	+0·2	72	95	6·6	9·78	14	+ 3·29
Kurunegala	90·2	—0·9	74·9	+0·3	74	93	5·5	7·52	19	— 2·39
Mannar	89·3	—1·0	78·0	0	77	91	6·0	6·22	11	+ 2·80
Nuwara Eliya	71·2	—0·1	49·4	—0·3	78	98	5·8	7·17	12	+ 2·19
Puttalam	88·2	—1·0	76·0	—0·1	76	93	5·8	13·67	14	+ 8·79
Ratmalana	88·1	—	74·6	—	72	90	6·6	5·11	18	— 5·46
Ratnapura	90·6	—0·5	73·9	+0·1	75	93	6·9	16·07	25	+ 4·50
Talawakele	77·6	0	57·3	—0·5	78	88	6·0	4·37	14	— 1·93
Trincomalee	88·9	—0·3	77·7	+0·1	74	89	5·9	3·91	5	+ 1·78

WEATHER SUMMARY, APRIL, 1951

Afternoon or evening thunderstorms were a regular feature of the weather during April. They were experienced fairly frequently and extensively over the Island, except on the east side. The resulting rain was moderately heavy and widespread on several days, particularly the 11th, 13th and 19th. The only appreciably dry days in April were the 22nd and 26th. Pre-monsoon thundery showers which occur about dawn along the South-west coast were in evidence form the 18th to 21 st and again on the 28th.

At a majority of stations the monthly rainfall ranged from 5 to 15 inches, while larger amounts were recorded in the south-western mid-country and at a few stations among the Haputale hills. Largest totals were 25·22 inches at Kumbaduwa Estate, 23·29 inches at Digalla Estate, 23·15 inches at Lunugala Estate, and 22·08 inches at Chesterford Estate. Least rain (below 5 inches) was experienced in Jaffna Peninsula, Eastern Province, and Hambantota District.

As the precipitation was mainly in the form of local thundershowers, the distribution was rather irregular, comparatively large excesses being found side by side with large deficits. In the north and north-west, the rainfall was generally well above normal. Largest excesses, amounting to 5 to 10 inches, occurred mainly in the North-Western Province and included 9.98 inches at Battulu Oya, 9.62 inches of Puttalam Western Saltern, 9.25 inches at Karaitivu, 8.79 inches at Puttalam, and 8.58 inches at Pelwehera. Biggest deficits were 5.96 inches at Millawa, 5.83 inches at Angamedilla, and 5.69 inches at Depedence Group.

There were 7 daily falls over 5 inches during April, the highest being 6·63 inches at Buttala on the 19th and 6·33 inches at Blackwood Estate on the 29th.

Day temperatures were below normal, and night temperatures about normal. The highest recorded temperature in the shade was 96·0° at Anuradhapura on the 7th, while the lowest temperature for a low-country station was 71·9° at Ratmalana on the 12th. The lowest temperature for the whole Island was 42·1° at Nuwara Eliya on the 6th. The mean humidity varied from 70 to 80 per cent. by day, and from 85 to 95 per cent. by night. The cloud amounts were appreciably above average. The wind strength was below normal, the direction being variable.

D. T. E. DASSANAYAKE,
Director.

METEOROLOGICAL REPORT, MAY, 1951

STATION	TEMPERATURE				HUMIDITY		Amount of Cloud	RAINFALL		
	Mean Maximum	Offset	Mean Minimum	Offset	Day	Night (from Minimum)		Amount	No. of Rainy Days	Offset
	°	°	°	°	%	%		in.		in.
Anuradhapura	92·0	+1·2	76·4	+0·1	67	91	4·2	6·14	6	+ 2·60
Badulla	85·4	0	65·5	—0·9	71	95	4·4	9·17	13	+ 4·48
Batticaloa	89·2	—1·0	77·4	—0·4	74	89	4·5	0·78	4	— 1·01
Colombo	86·9	—0·1	77·2	—0·4	80	91	6·4	22·00	21	+ 6·51
Diyatalawa	77·8	—0·8	61·5	—0·6	74	92	5·2	6·06	18	0
Galle	85·3	+0·3	77·0	—1·1	77	84	5·9	14·63	22	+ 1·96
Hakgala	—	—	—	—	—	—	—	—	—	—
Hambantota	87·0	+0·2	77·6	+0·1	81	89	6·2	6·32	11	+ 2·05
Jaffna	88·8	+0·7	82·5	+0·9	76	81	4·6	0·32	3	— 1·68
Kandy	89·0	+1·9	70·2	—0·8	69	92	4·8	4·13	9	— 3·44
Kankesanturai	—	—	—	—	—	—	—	—	—	—
Kurunegala	89·5	+0·3	75·7	—0·3	72	88	4·8	6·05	9	— 1·50
Mannar	90·4	+0·9	81·0	+0·4	75	85	4·8	0·98	3	— 0·81
Nuwara Eliya	71·3	+0·9	52·0	—1·2	80	97	5·0	6·02	15	— 2·45
Puttalam	88·6	+0·4	78·0	—0·8	76	91	5·4	9·14	8	+ 5·37
Ratmalana	86·7	—	76·6	—	77	86	6·4	29·99	23	+13·58
Ratnapura	89·4	+0·5	74·6	—0·4	76	93	6·2	24·91	23	+ 4·00
Talawakele	78·1	+2·6	58·8	—0·9	76	88	4·9	4·82	17	— 4·59
Trincomalee	93·1	+1·1	78·3	—0·4	68	84	5·4	2·43	7	— 0·80

WEATHER SUMMARY, MAY, 1951

The south-west monsoon set in during May, but the winds were not strong engough to convey the moisture to the central hills. As a result, the rainfall was more or less concentrated in the south-western coastal regions, fairly large deficits being found on the windward slopes of the hills.

There was heavy rain on the 6th all along the south-west coast from Ambalangoda to Negombo, and on the 12th in a north-westerly belt from Ratnapura to Negombo, with daily falls amounting to over 5 inches. On the 30th rainfall was heavy and widespread over the Island, with the highest falls over 5 inches in the neighbourhood of Negombo and Puttalam. Thunder activity, which was widespread over the Island on the 1st, 2nd, 7th and 24th, was also well in evidence among the hills and on the east side during the second half of the month.

The biggest rainfall totals were found in Kalutara District, where Kumbaduwa Estate recorded 37·81 nches for the month and Bandaragama 34·09 inches. Other totals over 30 inches were 32.66 inches at Opata, 32·10 inches at Kottawa (Galle), 30.24 inches at Moratuwa, and 30·23 inches at Nagoda. Rainfall decreased towards the north and east, the monthly totals among the hills generally ranging from 5 to 10 inches. In the north and the east the rainfall was less than 5 inches. Least rain (below 2 inches) was experienced along the south-east coast and in the neighbourhood of Mannar and Kalawewa.

Greatest excesses occurred in the south-western coastal regions, where Kottawa recorded 15·07 inches above average. Other outstanding excesses were 14·90 inches at Moratuwa, 13·98 inches at Bandaragama, 13·58 inches at Ratmalana, and 12·58 inches at Wester Seaton Farm. Greatest deficits were found on the south-western slopes of the hills, the rainfall at Watawala and Kitulgala being below normal by as much as 13·42 and 10·86 inches respectively. Elsewhere over the Island the rainfall had not deviated much from average. There was, however, an appreciable excess of rain in the immediate lee of the hills.

Seventy daily falls over 5 inches were registered in May, most of them occurring on the 6th, 12th or 30th. The highest were 11·33 inches at Kanangama Estate, Dehiowita, on the 11th, and 10·10 inches at Minuwangoda on the 12th.

Temperatures were above normal by day and below normal by night. The highest recorded temperatures in the shade were 95·7° at Trincomalee and 95·2° at Anuradhapura on the 16th, while the lowest temperature for a low-country station was 71·6° at Kurunegala on the 24th. The lowest temperature for the whole Island was 44·3° at Nuwara Eliya on the 11th. The mean humidity varied from 70 to 80 per cent. by day, and from 85 to 95 per cent. by night. The cloud amounts were a little above average. The wind strength was below normal, the prevailing direction being south-westerly.

D. T. E. DASSANAYAKE,
Director.